Heating and Ventilating

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

Volume 29 | DECEMBER, 1932 | Number 12

CONTENTS

Pipe Welding Developments Affect Engineers and Contractors 13
Ice Chosen as Refrigerant for Wabash Cars 16
Calculating Radiation by Use of Charts ..... *Lawrence Corlett* 17
Panorama Building Heated by Warm-Air System ..... *A. E. Beitzell* 20
British Scientists Consider Control of Atmospheres 22
A Method for Selecting Outside Weather Conditions for Air Conditioning Design ..... *H. W. Skinner* 23
The Relation of Climate to Air Conditioning Design ..... *Otto W. Armspach* 26
Heating and Ventilating a County Home with 123,000 Sq. Ft. of Radiators (Conclusion) ..... *Frank L. Wadsworth* 30
Estimating Steam Consumption Where Less than 70° is Maintained ..... *Robert L. Fitzgerald* 33
Steam Meters in the Heating System ..... *Fred G. Austin* 35
Air Conditioning a Residence with District Steam ..... *W. H. Rudisill* 39

DEPARTMENTS

Editorials 42
Your Everyday Problems 43
Abstracts 44
News of the Month 47
New Equipment 53
Degree Days for October, 1932 58
The Weather for October, 1932 60

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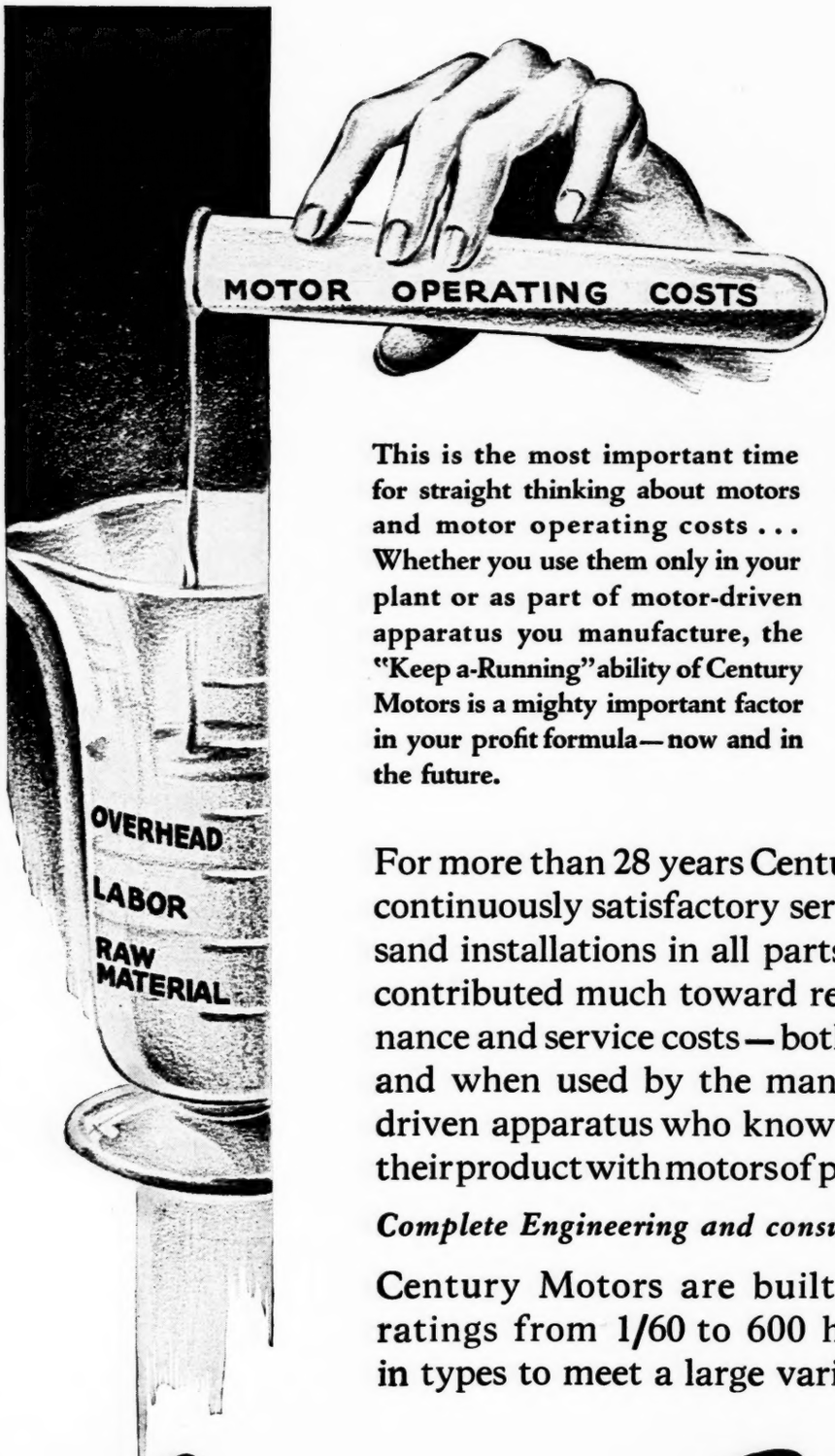

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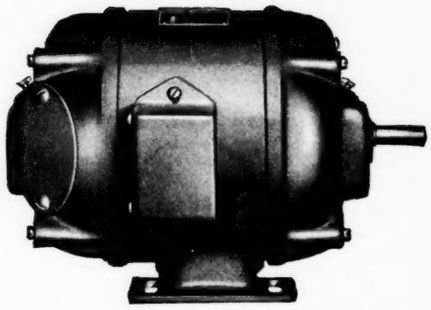

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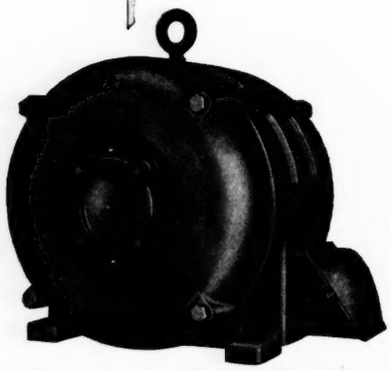

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Pipe Welding Developments Affect Engineers and Contractors

Survey of current welding specifications shows increased use of pipe welding and welding fittings.

THE ENGINEER ASKS:

Shall I call for welding of the piping, or make it optional?

What's the smallest size that should be welded?

What are the others doing about welding?

Do the contractors favor welding if they have a free choice?

THE CONTRACTOR ASKS:

How is this pipe welding affecting me?

Am I losing work because I don't weld?

What about welding fittings—shall I keep on fabricating my own, or use the manufactured fittings?

THESE are only a few of the questions which have been raised regarding the present status of pipe welding in building work and it has seemed that one way to get at the answers, and to get a reasonably broad view of the situation, would be to actually examine the specifications of some current jobs.

Accordingly, we have gone over the paragraphs relating to welding in the specifications of 98 projects which have been released between September, 1931 and October, 1932. While not all have actually gone forward to completion or to the awarding of contracts, they are current and represent latest practice. More than that, the projects were not selected but were taken in the order of their appearance so that they represent a fair cross-section of the kind of specifications now being written on the new work available to contractors for bidding. The list is the kind which would interest a contractor who does work on new medium-sized to large jobs over an area of two or three states.

Our procedure was to examine the paragraphs and to tabulate the items bearing on the questions to be studied. This resulted in a chart from which totals could be obtained and from which information could be picked readily. While this chart simplifies the subject and makes it comparatively easy to get the picture at a glance, it is not reproduced because of its size. Instead, we will summarize the principal points that we found.

Kinds of Buildings Surveyed

First of all let us get a clear notion of the nature of the buildings included. Who are the owners, and what kind of buildings are they?

Answering the first question brings out the well-known falling off in private work which has taken place, for only nine of the 98 are the property of private owners. The other 89 are owned by government divisions and we can catch the importance of government building nowadays.

Of the 89 government-built buildings 47 are federal, and are classified as follows.

Treasury Department	
Post offices	21
Public Buildings	11
Veterans Administration	11
Navy Department	3

State government buildings accounted for 22, while local government agencies including cities, counties and schoolboards make up the remaining 20. Thirteen school buildings are included in the latter group.

The nine private jobs include two office buildings—one very large—one telephone building, one industrial, one club, a theater, a hospital, a gymnasium, and a medical office building.

The jobs range in size from rather small post offices and consolidated rural schools to very large, through institutional groups. The federal buildings are scattered over several states, while the state, local, and private jobs are nearly all located in two eastern states.

The building types classify as follows: Post Offices 21, Hospital Buildings and Groups 26, Prison and Asylum Buildings 6, Schools 13, Armories 4, Offices 5, Miscellaneous 23.

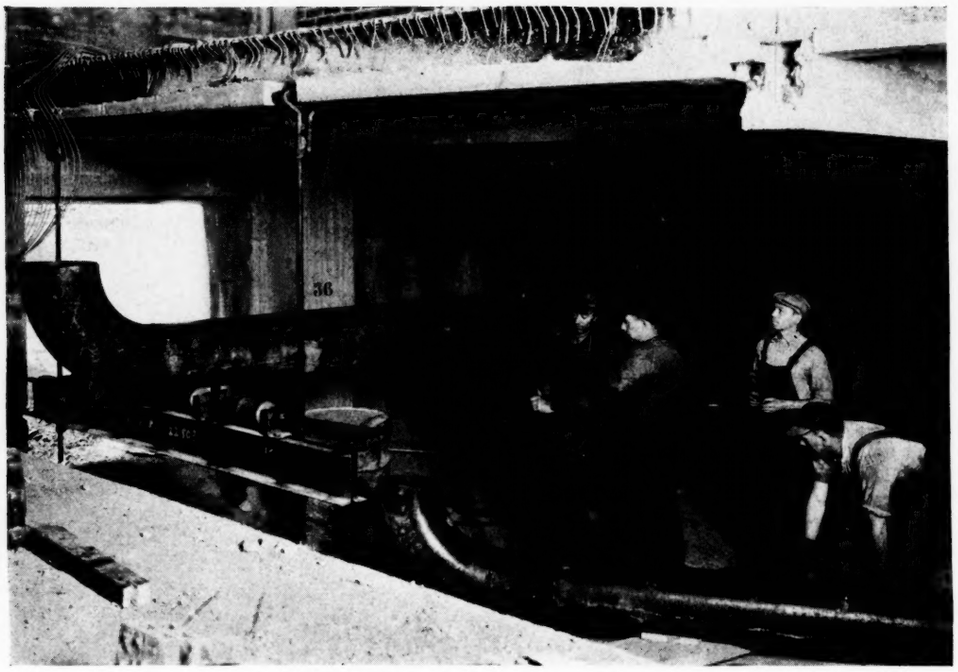
The specifications were prepared in the offices of 25 separate engineering firms and by the engineering staffs of three federal, five state and two municipal departments. Surely such a list is representative.

What the Survey Shows

The most immediately evident and interesting point is that *the specifications without exception mentioned welding* as a method of erecting and joining pipe. This is in itself an eye-opening fact, for it shows the agreement among specifiers that they are justified in permitting or demanding pipe welding.

Specifications either required the use of welding or they made its use optional with the contractor. In a few cases bids were asked with the use of welding as an alternate in order to take advantage of any saving made either way.

The count of the several classes of specification is interesting. *In 30% of the projects the specifications were so worded that a contractor would be required to weld* at least some of the pipe if he obtained the job. That is, he would have to be ready to weld if he entered a bid. *In 50% of the cases, the use of welding was authorized* and the choice left with the successful bidder, while on three cases alternates were specifically asked for, with a price each way. The wording of the specifications was so obscure in the remaining seven



A welded heating line during erection, with fittings welded before pipe is in position. Photograph courtesy of Tube-Turns.

cases that it was not possible to determine just how things stood.

Where the use of welding was left optional the most popular smallest pipe size on which welding was to be used was the 3-in. In fact, in only nine was the limit placed at other sizes. Of these nine, only one placed it at 4 in., while four permitted welding to even the smalles sizes.

Where the use of welding was *required* there is no such agreement on any one pipe size for a minimum. The 4 in., 3 in., 2½ in., and 2 in. were each mentioned with equal frequency, while the sizes below were but little less popular. In other words, if welding was required it was commonly extended to small sizes.

The reason why the 3-in. size was so popular with optional work is because most of the federal government specifications called for optional welding and set the minimum size at 3 in. Eliminating the federal specifications—and particularly those for post offices—would remove the 3-in. size from its prominent position.

While there was no agreement as to where the minimum welded size should be placed, it is important that *where welding was required outright in a specification there was much more tendency to call for its use even into the smaller sizes* than was the case where its use was optional.

In the same way that the federal specifications were usually optional there was a *decided tendency for the state and municipal specifications to require welding.* Too much weight should not be placed on this, however, for it must be recalled that these specifications came from two states only, and practices vary in other states.

Welding in Private Jobs

Although the items already noted are of interest and importance, they are necessarily colored by the presence of so much government work in the list. While of current importance it can scarcely be expected that government work will continue to dominate building activities. We will see a resumption of private work and then an important question will be—"How is the engineer handling his specifications?"—for he will be free of the necessity of following government policies. Also—"Is the contractor taking kindly to the use of welding?" Examination of the list of specifications throws some light on these questions.

If the private work, and those projects on which engineers are left practically free to follow their own inclinations, are looked at separately we get an idea of how welding is faring at their hands. There are two classes of this work, viz., (a) strictly private projects, and (b) work for local government bodies on which there is but little supervision aside from that of the engineer himself. Let us look at them separately.

Of the nine private projects, welding of at least some part of the heating piping is definitely required on seven and is optional on two. Of the seven on which it is required, five call for welding on sizes 4 in. or larger, one requires its use down to the 1¼-in. size, and the minimum size is not clear on the remaining one. Of the two on which its use is optional, it appears that the contractor is free to use it in as small sizes as he sees fit.

It is difficult to separate out the buildings on which private engineers are given a substantially free hand in specifying on local government work, but examination of the list shows that there are at least 15 which would fall in this class. Of these, welding is definitely required on six and is optional on nine. Where required, the 2-in. size is the minimum most often stated; where optional, the minimum size is seldom stated and the contractor is left free to weld in as small sizes as he sees fit.

Consideration of these two groups together shows that welding is required on 13 and optional on 11. These two groups combined make up about one-fourth of the total projects, and the percentage on which welding is required is 54. This is considerably greater than the 38% found when the whole group is considered.

In the matter of minimum size the projects in these

two subdivisions show a considerably greater tendency to permit a free option as to size than is shown in the whole group. Where welding is required it cannot be shown, though, that there is any tendency to demand its use in smaller sizes than for the whole group.

How Optional Jobs Go

The question of what the successful bidder does when he has the option as to whether to weld or not is of considerable significance, for it sheds light on the attitude of the contractor towards welding. In order to get at this the list of projects was examined to learn how the job actually went in case the specification was optional. Complete information could not be secured on this point. It was possible, however, to identify 11 cases in which the job actually went welding. No doubt some others did too, but the information is questionable. This indicates that in at least *a goodly proportion of the cases the optional job ultimately goes welding and that the contractor finds it to his advantage to use it.*

Adding the 11 optional jobs to the 38 on which welding was required gives 49, or half the list is known to have actually used welding either from choice or necessity. It is also very probable that more than half actually will use welded piping. It is safe to conclude, therefore, that over half the current jobs in this class of work are using welded piping.

Specifications Variously Worded

Examination of the wording of the specifications showed a wide variety. They varied all the way from a simple statement that "welding of black steel pipe may (or shall) be used in all sizes above 2 in." to elaborately worded ones which went into considerable detail as to methods of testing the welder and the welded pipe, the welding rod to be used, the strength of the weld, the angle of chamfer of the pipe, and the kind of fittings to be used. This lack of uniformity in wording is one of the outstanding features and goes to show that if there is any such thing as an ideally-worded welding specification it is not in use currently. Even the government specifications are not entirely uniform in wording.

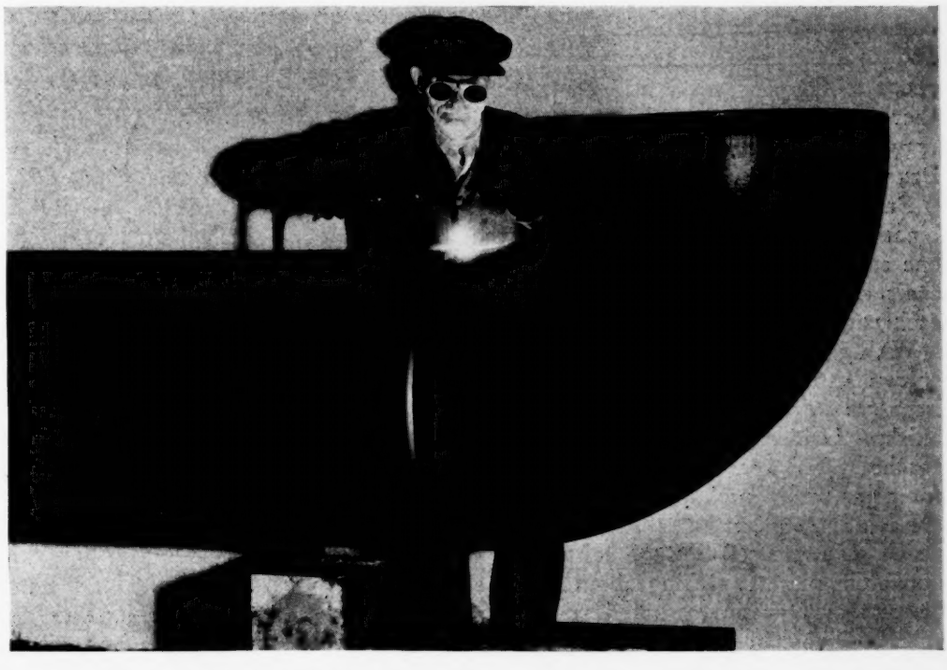
In general, the specifications showed no discrimination between gas and electric welding, and it may be assumed that engineers are willing to have either method used.

Factory-built welding fittings are comparatively new and it is rather surprising to note how often their use with welding was called for. Engineers are evidently well impressed with their value on the job. *Where welding was definitely required in the specifications, welding fittings were required in* 14 *cases. Where welding was optional, the use of welding fittings if welding was used was required in* 23 *cases.* In three additional cases their use with welding was optional. Practice regarding the requirement varied greatly. Some mentioned the fittings to be used by manufacturer's name; others stated that "factory-built welding fittings must be used where pipe is welded"; others state the minimum face-to-center dimensions of the fittings to be used, and still others stated that "mitered joints will not be permitted." Use of welding nozzles for side connections is noted as permissible in many cases, while in others tees are required and no uniformity is shown in this regard. In several cases welding of risers and radiator runouts is excluded, as is welding at connections at valves and apparatus.

What is the Meaning?

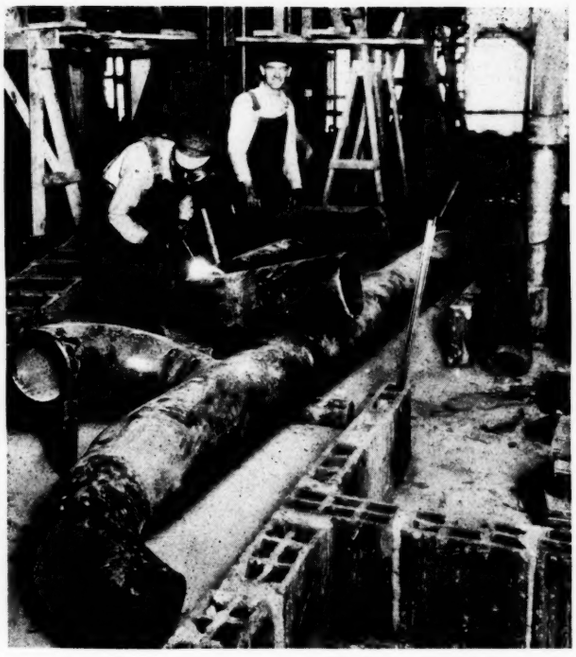
The question may well be asked "What does all this mean?" and the answer is that the facts brought out by these specifications mean a good deal to both the engineer and the contractor.

To the engineer who is still steadfastly refusing to permit the use of welding it means that his practice is



Factory-built welding fittings are being more and more used—here is one of the largest ells ever built being welded to the line. Photograph courtesy of Taylor Forge & Pipe Works.

out of line with that of other current work. If so many others find it desirable to either require or permit the use of welding, why should he not do the same by adjusting his practice? To the engineer who is already writing welding into his jobs it shows that he is in agreement with current practice. It also shows the rising popularity of welding fittings and should cause him to ask himself if he is not justified in falling into line. Moreover, it shows that smaller lines are being welded in building heating work and lets him check up on his practice in this connection. Enough information about the wording of specifications is also included so that he may examine his to see if they can be improved.



A floor weld before the heating pipe is put in place. Photograph courtesy of Tube-Turns.

Certainly there are facts here of both interest and concern to the contractor. If half these current jobs are going welding, and with the tendency in private work even more marked, *the contractor may well begin to take notice of the fact that unless he is prepared to weld he is not only being excluded from bidding on a good part of the current work in this class, but there is considerable indication that soon he will be excluded from a larger part.* The government work which is in some cases now deliberately being made optional just to permit a bid by contractors who are not prepared to do welding, will not dominate the building field forever. When private building increases again, there is not likely to be any such compunction about letting the non-welding contractor bid. As it takes time to build up a welding organization and to learn how to handle the work to advantage, it is not too early now to get the plans under way for what is sure to be a necessity later on.

Ice Chosen as Refrigerant for Wabash Cars

USING ordinary ice as a refrigerant, the Wabash Railway has developed its own type of air conditioning equipment for passenger cars after extensive experiments and study of the various kinds of equipment in use on other railroads. Simplicity, cost of installation, and the absence of failures in transit were the deciding factors in favor of ice over mechanical devices, and the cooling equipment designed and built in the Wabash shops at Decatur has been thoroughly tested on the regular run of the Wabash Banner Blue Limited between St. Louis and Chicago.

Pullman parlor cars and diner, club and parlor combination cars are to be fitted with one ice bunker and one set of air conditioning equipment each, while the chair cars carry a complete air conditioning unit in each end.

With the plans and design completed, day coaches or cars can be equipped at a cost of about $3,200, a large part of which is chargeable to alterations and refinishing incident to installing equipment in the existing coaches. The same system built into a new coach or chair car would probably not run over $2,500.

Each ice bunker holds 1500 lb. to 1600 lb. of ice, which is introduced through a hatch in the top of the bunker in pieces weighing about 50 lb. each. The air blowers or fans are actuated with ¼-hp., five-speed motors. The cold water circulating pumps have ¼-hp. motors, and the combined load of all motors, which is 1 hp. can be supplied by the standard 500-amp-hr. batteries and 4-kw. generator already under the car.

Test runs over an extended period of time showed a high degree of comfort from the equipment. With all windows tightly closed there was freedom from dust, and a large amount of the usual noise was eliminated. Effective temperature held at from 74° to 80°, corresponding to 94% or better on the comfort cooling scale, when the outside temperature went as high as 98°, dry bulb, with a high relative humidity.

The air blowers or fans delivering 25% fresh air from outside and 75% recirculated air, kept the interior fresh and cool and were very effective when passengers were smoking.

Operating costs were not figured exactly, but the average hot weather consumption of ice with the average passenger load is estimated at about 325 lb. per hr. per coach, or about one ton for each coach on the St. Louis-Chicago run.

The small power consumption of the Wabash cooling design and the ability to derive power from existing equipment on the coaches were heavy factors in favor of the ice system. The ice system also overcomes the difficulties due to leaky joints and the breaking of small pipes from vibration in transit.

The annual index for the 12 issues of HEATING AND VENTILATING for 1932 has been prepared and will be mailed on request to any subscriber without cost. Address Subscription Department, HEATING AND VENTILATING, 148 Lafayette Street, New York.

Calculating Radiation by Use of Charts

By LAWRENCE CORLETT

THE accompanying charts can be used to compute the heat loss through outside walls, floors, ceilings, roofs, inside partitions, windows, and the heat loss due to infiltration of air into a room through outside windows or doors.

Chart 1

This chart is designed for a 70° temperature difference, that is, a 70° room temperature and a 0° outside temperature. If the conditions are other than this, the total radiation as figured from the chart can be corrected by multiplying the radiation by a correction factor obtained from the table at the bottom of the chart.

For the common constructions, values of the coefficient of transmission in B.t.u. per hour per square foot per 1° temperature difference can be found in any standard reference book on heating. For special constructions, the coefficients of transmission must be computed.

The transmission coefficient for single glass is 1.13.

A value of 0.018 B.t.u. was used as the amount of heat required to raise the temperature of 1 cu. ft. of air 1°. The amount of infiltration in cubic feet per hour per foot of crack varies for the different types of windows and also with the wind velocity.

For good construction (1/32 in. sash clearance) and a 15 m.p.h. wind velocity, a leakage value of 70 cu. ft. per hr. per ft. of crack is commonly used.

For poor construction (1/16 in. sash clearance) and a 15 m.p.h. wind velocity, a leakage value of 140 cu. ft. per hr. per ft. of crack may be used.

The A-scale gives the area of wall, glass, roof, ceiling, floor, or partition surface in square feet. The same graduations are also used for lineal feet of crack when figuring the infiltration around windows or doors.

To solve a problem with Chart 1, lay a straight edge through the proper quantities on scales (U) and (A). Where the straight edge crosses scale (R) read the square feet of direct steam radiation required. The heat loss can be read on scale H. The operations are numbered on the key sketch on the chart.

Example: A room has a southern exposure and is to be heated to 70° with 0° outside temperature. It has 125 sq. ft. of net exposed wall surface, 90 sq. ft. of glass surface, and 90 lin. ft. of window crack. Coefficient of transmission for wall is 0.22 B.t.u. per sq. ft. Leakage assumed at 70 cu. ft. per hr. per lin. ft. of crack.

Procedure: For wall loss: Lay a straight edge through 0.22 on scale (U) and 125 on scale (A) and where the straight edge crosses scale (R) read 8 sq. ft. of radiation.

For glass loss: Lay a straight edge through 1.13 on scale (U) and 90 on scale (A) and where the straight edge crosses scale (R) read 30 sq. ft. of radiation.

Leakage loss: Lay a straight edge through 70 cu. ft. per hr. on scale (U) and 90 lin. ft. on scale (A) and where the straight edge crosses scale (R) read 33.5 sq. ft. of radiation.

The total square feet of radiation would then be 8 + 30 + 33.5 or 71.5 sq. ft.

For temperature differences other than 0° to 70°, multiply the result obtained as explained above by the correction factors in the table with Chart 1. For example, if the inside temperature was to be 65° with a minimum outside temperature of 10°, multiply by 0.75.

Chart 2

This chart is based on the formula

$$H = (U_w A_w + U_g A_g + .018 L A_g) T$$

where H = Heat loss in B.t.u. per hour.

U_w = Coefficient of transmission of wall in B.t.u. per hour per square foot per 1° temperature difference

A_w = Square feet of net exposed wall surface

U_g = Coefficient of transmission of glass in B.t.u. per hour per square foot per 1° temperature difference

A_g = Square feet of exposed glass surface

L = Leakage in cubic feet per hour per square foot of window area[1]

T = Temperature difference in °F. between desired room temperature and the outside temperature.

The constants used in this formula for plotting the chart are as follows:

$U_g = 1.13$
$L = 70$

To solve a problem by Chart 2, lay a straight edge through the proper quantities on scales (W) and (U) and note where it crosses line (Y).

Connect this point on line (Y) and the square feet of glass surface on scale (G) with a straight edge and note where it crosses line (X).

Lay a straight edge through this point on line (X) and through the temperature difference on scale (T) and where the straight edge crosses scale (R) read the total square feet of radiation, or heat loss per hour on (H).

The different operations are numbered on the key sketches on the chart.

Example: A room has a southern exposure and is to be heated to 70° with 0° outside temperature. It has 125 sq. ft. of net exposed wall surface and 90 sq. ft. of

[1]The method of calculating infiltration is an approximation in which the designer calculates the leakage per unit of glass area rather than on the basis of lineal feet of crack around the window—EDITOR.

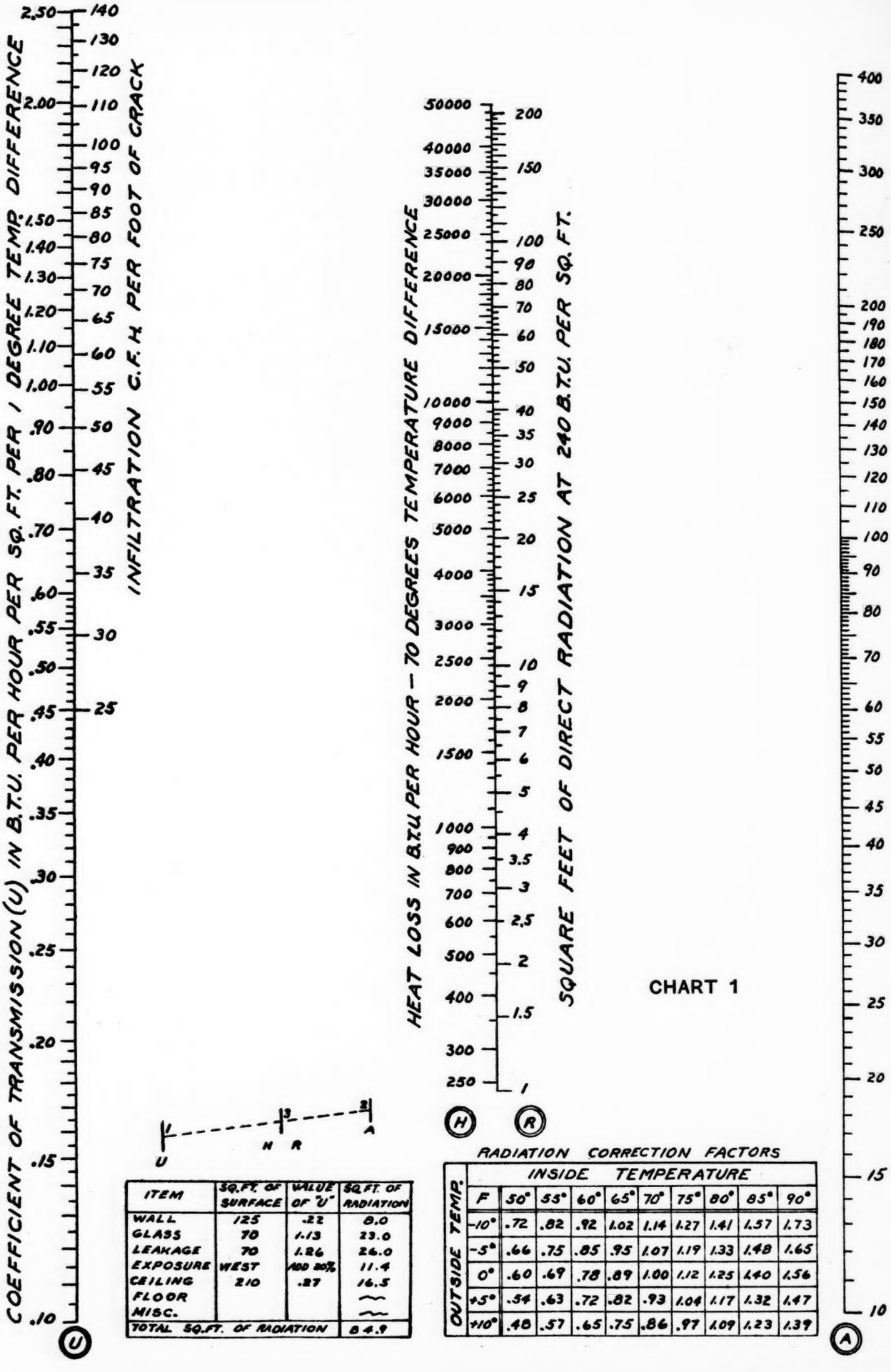

COEFFICIENT OF TRANSMISSION (U) IN B.T.U. PER HOUR PER SQ. FT. PER 1 DEGREE TEMP. DIFFERENCE
INFILTRATION C.F.H. PER FOOT OF CRACK
HEAT LOSS IN B.T.U. PER HOUR — 70 DEGREES TEMPERATURE DIFFERENCE
SQUARE FEET OF DIRECT RADIATION AT 240 B.T.U. PER SQ. FT.
AREA OF EXPOSED SURFACE IN SQUARE FEET OR LINEAR FEET OF CRACK
U
H
R
A

CHART 1

ITEM	SQ. FT. OF SURFACE	VALUE OF "U"	SQ. FT. OF RADIATION
WALL	125	.22	8.0
GLASS	70	1.13	23.0
LEAKAGE	70	1.26	26.0
EXPOSURE	WEST	100 80%	11.4
CEILING	210	.27	16.5
FLOOR			~~
MISC.			~~
TOTAL SQ. FT. OF RADIATION			84.9

RADIATION CORRECTION FACTORS

OUTSIDE TEMP. F	INSIDE TEMPERATURE 50°	55°	60°	65°	70°	75°	80°	85°	90°
-10°	.72	.82	.92	1.02	1.14	1.27	1.41	1.57	1.73
-5°	.66	.75	.85	.95	1.07	1.19	1.33	1.48	1.65
0°	.60	.69	.78	.89	1.00	1.12	1.25	1.40	1.56
+5°	.54	.63	.72	.82	.93	1.04	1.17	1.32	1.47
+10°	.48	.57	.65	.75	.86	.97	1.09	1.23	1.39

glass surface. The coefficient of transmission for the wall is 0.22 B.t.u. per sq. ft.

Procedure: Lay a straight edge through 125 on scale (W) and 0.22 on scale (U) and note where the straight edge crosses line (Y).

From this point on line (Y) lay a straight edge through 90 on scale (G) and note where the straight edge crosses line (X).

Lay a straight edge through this point on line (X) and 70 on scale (T) and where the straight edge crosses scale (R) read 71.5 sq. ft. of radiation.

When figuring additional heat losses as through floors, ceilings, etc., the procedure is the same as above except in the fourth operation numbered on the key sketch, connect the straight edge with the zero point on the (G) scale and then proceed as above.

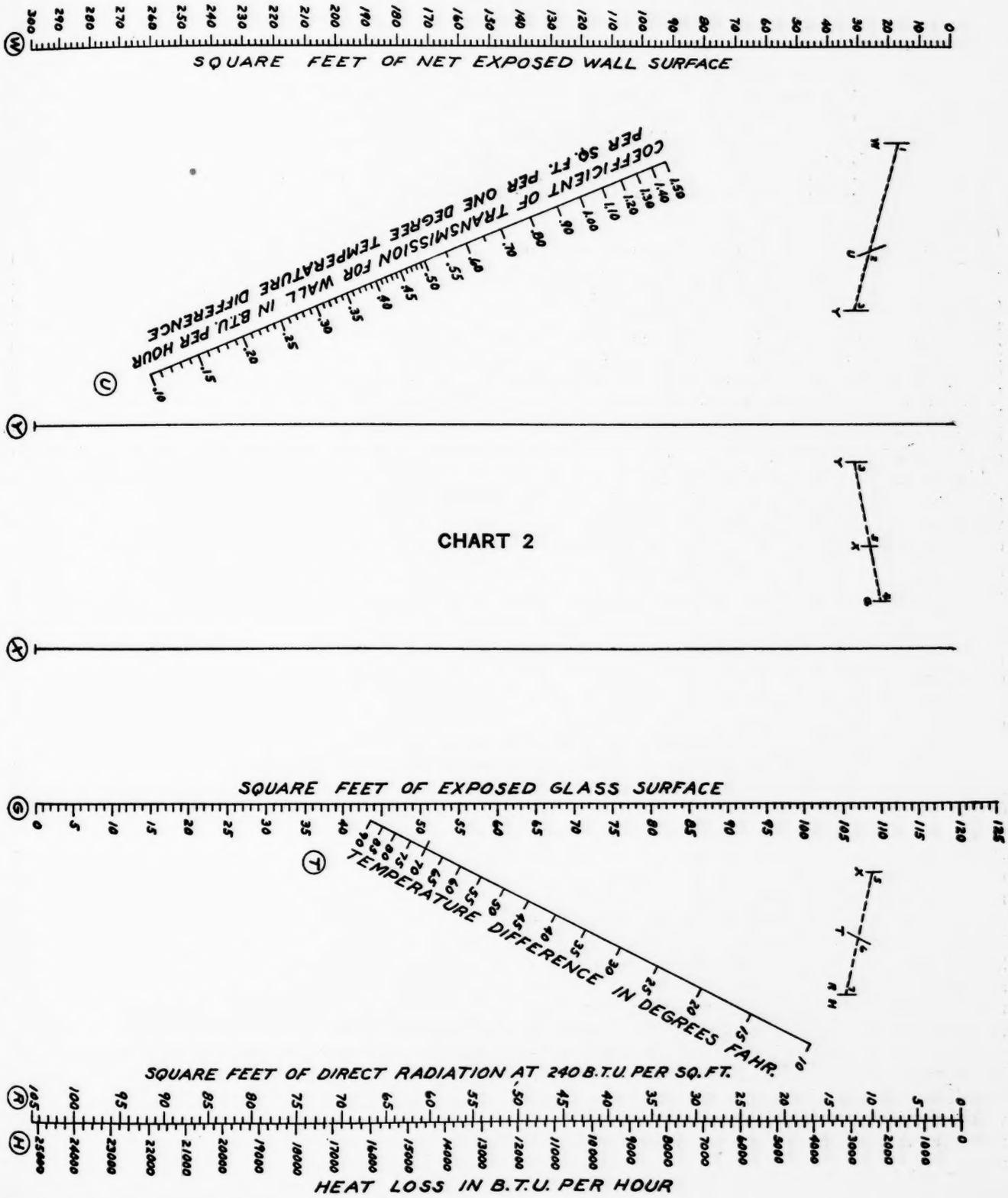

SQUARE FEET OF NET EXPOSED WALL SURFACE
COEFFICIENT OF TRANSMISSION FOR WALL IN B.T.U. PER HOUR PER SQ. FT. PER ONE DEGREE TEMPERATURE DIFFERENCE
SQUARE FEET OF EXPOSED GLASS SURFACE
TEMPERATURE DIFFERENCE IN DEGREES FAHR.
SQUARE FEET OF DIRECT RADIATION AT 240 B.T.U. PER SQ. FT.
HEAT LOSS IN B.T.U. PER HOUR

CHART 2

Panorama Building Heated by Warm-Air System

By A. E. BEITZELL†

The Pantheon de la Guerre, the world's largest painting—45 ft. wide and 402 ft. long—contains over 6000 life-size portraits of Allied heroes and statesmen, as well as many important World War battle scenes. It was viewed by six million persons during its exhibition in Paris, is now on display in Washington, and will be shown next year at the Century of Progress Exposition in Chicago. The author of the accompanying article describes the solution of the unusual problems connected with the heating and ventilating of the building housing the painting in Washington.

THE building in which the "Pantheon de la Guerre" is displayed is cylindrical in shape, fabricated entirely of sheet metal on a steel skeleton framework. The ribbed metal casing consists of sheets of heavy gauge galvanized iron impregnated on the outside with roofing compound and on the inside with a pressed asbestos mixture. It is said to be fire- and leak-proof and to have the insulating value of 1-in. board. The picture itself is suspended from a steel track running the entire circumference of the building.

Two circular observation platforms in the center of the structure permit the picture to be viewed with advantage from all angles. The lower platform, supported on a concrete foundation, is 5 ft. above the unfinished ground level, allowing the spectator a close-up view of the lower half of the picture. The upper platform is spaced 8 ft. above the lower, or 13 ft. from the ground. Two stairwells on either side of the center column permit access to the higher level. The lower platform connects to a lobby with a covered ramp, similar ramps leading to the exterior as emergency exits. Canvas canopies were extended a short distance from the floor level of both platforms to permit a full angle view of the picture while concealing the unfinished ground level. A similar canopy draped above the top platform conceals the upper steel framework from the spectator.

In considering a suitable method of heating and ventilating the building, several factors had to be considered in the design of the system which are not ordinarily encountered in routine practice. First, it was neither practical nor desirable to heat the entire building, since only the platforms were to be occupied. Second, the concentration of occupants within a relatively small area necessitated a vigorous air circulation for quick dissipation of body heat and moisture, resulting in a much higher quantity of air for summer use than would normally be required for winter heating. Air velocities had to be chosen which would permit the air to carry the full extent of the platform, but which would not be too high to be carried away by natural currents during the heating season. Outlets had to be arranged so as to permit an even air distribution without interfering in any way with the line of vision.

Other factors which had to be considered were the probable effects of the canvas canopies on the air distribution, the initial cost of the system, which had to be held to a minimum because of the temporary character of the building, and the operating cost of the equipment.

In the system as finally decided upon as most nearly fulfilling all desired requirements, fresh air is drawn into the building through a series of louvers located in each bay of the exterior wall below the base of the picture. A large disk fan supported in a sturdy ventilator in the center of the roof exhausts sufficient air to afford a 10-min. air change in the building. Since the canopies would preclude to a large extent an induced flow over the platforms, an auxiliary circulating system was necessary to provide air movement in these areas. It was deemed advisable to incorporate both heating and ventilating equipment in a single element.

A large oil-burning furnace was placed under the upper platform adjacent to the center beam of the building. The furnace chosen contained an unusually high ratio of heating surface to grate area. The combustion chamber is constructed of welded chrome steel, lined with firebrick tapering to a point at the top, affording ample space for complete combustion of the oil flame. Twelve transfer tubes tap in on either side of the combustion chamber and lead to common headers close to the base of the furnace. The hot gases of combustion travel counter-flow to the entering air, resulting in a maximum rate of heat transfer. Eight large blower heads are mounted directly above the furnace, supported independently by a special steel framework. These blowers are protected from the radiant heat of the furnace by a rock wool blanket suspended between the top of the transfer tubes and the blowers. A galvanized steel casing, attractively painted and finished with chrome trim on the corners, completes the assembly. The furnace blowers discharge into a plenum chamber constructed the full size of the casing and carried to the lower side of the top platform.

A series of trunk lines conveying air to both the

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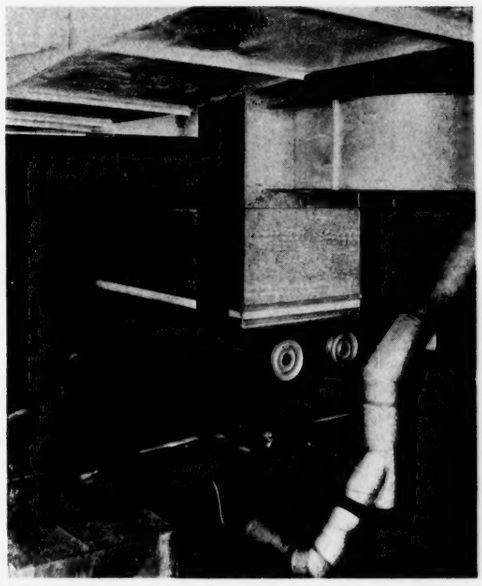
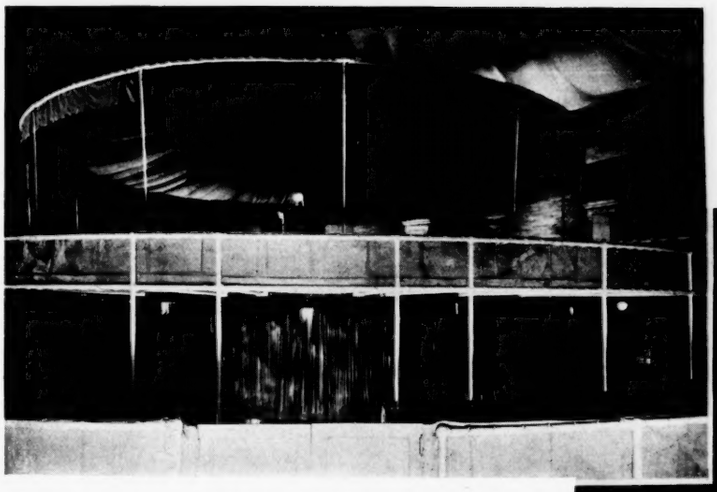
Oil-Fired Furnace Heats Panorama Building

Left—Exterior of building. The cyclorama is located in the interior of the large structure in the rear and reaches from the fresh air louvers, located in the outside wall, to the roof and runs around the entire building.

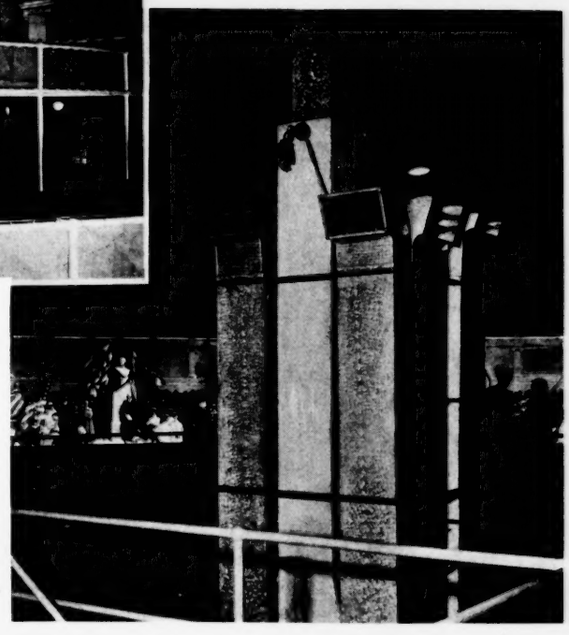
Left—View during construction showing interior of furnace prior to erection of casing. Blowers, their independent support, combustion chamber, transfer tubes and headers are visible. Fresh air louvers are shown at the bottom.



Above—View below upper platform showing the rear of the Dailaire furnace. The driving motor, pulleys on the twin blowers and stack can be seen. This view gives a good idea of the plenum chamber and the method of joining the distributing ducts to it.



Above—Interior of building showing upper and lower platforms and canvas canopies for concealing framework of building from the spectators. The outlets used for distributing air to both platforms may be seen.



Right—View on upper platform. Because of space requirements, it was impossible to run more than three ducts to this platform from the plenum chamber below. These ducts were subsequently concealed by drapery. A partial view of the painting can be seen.

upper and lower platforms was taken off the plenum close to its upper edge. These ducts radiate in an octopus-like fashion to the various discharge openings. In order to minimize the frictional resistance in the duct system, a velocity of 625 f.p.m. was estimated for the main trunk lines, with a corresponding lower velocity in the branch runs. Subsequent test results showed a remarkably low power consumption, as more than 16,000 c.f.m. are moved with less than two connected horsepower.

Supply ducts to the lower platform were taken from the plenum at three points in order to equalize the length of the runs. These main trunks supply eight branch ducts which discharge above the breathing level at equal distances about the circumference of the platform. All ducts were carefully sized to maintain equal static pressures at the outlets. Although dampers were placed in the individual runs, it was not necessary to change any setting after the system was placed in operation, which fully repaid the contractor for the extra care used in sizing his ductwork. The outlets used for the lower platform supply were constructed with special diffusing vanes to discharge the air equally in all directions. These diffusers were especially important due to the extremely short blow to the edge of the platform.

Running the supply stacks to the upper level was complicated by the fact that the only space available was about the center column of the building which was encumbered by a steel ladder leading to a lighting loft, the furnace stack which was attached to one of the center beams and electrical conduit running to the loft. Three ducts were finally run vertically and outlets taken off at right angles so as to sweep the platform uniformly in all directions.

These outlets were designed for the job, consisting simply of a right angle elbow arranged to blow slightly downward. Splitters placed in the outlets reach vertically into the duct below the base of the elbow. The velocity chosen for this discharge was 800 f.p.m., which was believed sufficient to carry to the edge of the platform.

Return ducts for the system are located in the lower platform only, two of the returns, placed at the base of the stairways leading to the upper platform, being depended upon to draw air from this level. The draperies concealing the interior of the lower platform were raised a distance of 6 in. from the floor to permit free access for the balance of the return air.

The system is controlled manually during the summer months. For winter operation it is planned to install thermostats on the upper and lower platforms which will actuate damper motors placed in the ducts serving these levels. The oil burner is so arranged as not to cut out until both thermostats have been satisfied. The usual safety controls for the furnace have likewise been installed. It is not planned to run the top ventilator during the heating season, as the normal infiltration of the building was thought sufficient for all normal ventilating demands.

British Scientists Consider Control of Atmospheres

THEORETICAL and practical aspects of the artificial control of humidity in factories, public buildings, and private dwellings were discussed by prominent British engineers and ventilating experts at the annual congress of the British Association for the Advancement of Science, held recently.

It was stated in a paper by Dr. S. G. Barker and M. C. Marsh that the control of humidity in testing rooms was a vastly different problem from that in textile mills, as more precision is required in the former. Determination of the best means of humidifying and drying the air in a small room has needed a good deal of research, and an inexpensive apparatus has now been evolved which has been adopted by certain of the government departments, railroads, and factories.

Discussing the two main types of humidity control in use—the wet and dry bulb, and the hair or membrane type—the lecturers observed that the bulb type of control had the advantage of constancy, provided it was kept in good order. A dirty covering on the wet bulb, or lack of water, will render the whole instrument inaccurate. The authors considered the hair or membrane type very suitable for use in mills, especially where there may be plenty of dust and lint in the air.

A detailed description of the experiments in the development of the hair type of electrical humidity control was given and recent developments were discussed. The comparatively recent introduction of thermionic tubes containing mercury, called gas-filled relays and thyratrons, promises to have a considerable effect on the design of temperature and humidity controls by replacing the mechanical type of relay.

Explaining the process and its adaptation to the needs of the room at the moment, the authors stated that "floating action" control was obtainable electrically. Up to the present, unless very complicated devices are used, it has been impossible to get such action electrically. While these developments are still in the experimental stage, it is felt that they will shortly have practical applications of a most useful character.

Central heating, and the use of electric radiators and gas fires, are making it necessary to add water to the air of rooms to keep pleasant and healthy conditions. America has paid attention to this problem, and the day will certainly arrive when the matter will have to be faced in the United Kingdom for hotels, blocks of apartments, houses, picture theaters, etc. To bring this about, the architect must first be acquainted with the details of the problem. The control of the atmosphere must be considered as an essential element in the general design of buildings, and not as an afterthought.

Describing the apparatus for recording the moisture content of atmospheres, Doctor Barker expressed a preference for those embodying a hair. He mentioned that blonde hairs were best, but said long ones were now difficult to get. Horsehair is also useful. Doctor Barker indicated several ways of controlling atmosphere, including the recently discovered use of thermionic tubes and condensers, which will be found of great help in the future.—*A. C. Blackall.*

A Method for Selecting Outside Weather Conditions for Air Conditioning Design

By H. W. SKINNER†

WHENEVER an air conditioning problem is to be solved it is necessary to assume outside air conditions. Since there is no absolute basis for such required assumptions, we find various parties working on the problem or bidding on the job differing by several degrees in their assumed wet and dry bulb temperatures. This difference is important in the final result.

For example, with a building to be cooled from 95° to 80° dry bulb temperature, with a constant inside wet bulb of 65.2°, with a total heat content of 29.80 B.t.u. per lb., we find the following:

Assumed outside wet bulb.....	78°	77°	76°	75°
B.t.u. per lb. outside air.....	40.64	39.67	38.75	37.81
B.t u. per lb. inside air.....	29.80	29.80	29.80	29.80
B.t.u. per lb. removed.....	10.84	9.87	8.95	8.01

Thus the relative percentage of heat to be removed increases rapidly for every degree increase in assumed outside wet bulb. The heat to be removed if we assume an outside wet bulb of 75° is only 73.9% of that required with an assumed 78°, 82.5% of that with a 77°, and 91% of that with 76°. In other terms, an assumed 78° requires 109.8% of that with 77°, 121.1% of that with 76° and 135.3% of that with an assumed 75°. In short, a difference in assumed outside wet bulb of one degree makes a difference of about 10% in the resulting load, while a two degree difference means a change of 20% in the load, and three degrees a difference of about 35%.

In order to determine a proper basis for the selection of outside conditions for design, a study of Weather Bureau records was made. It was found that while many stations have complete readings, covering wet and dry bulb temperatures three times a day for some years past, others may take only two readings a day, with the records extending back over a short period only. Further, no record is made of the wet bulb reading simultaneously with the maximum dry bulb reading, as the latter is taken from automatic recorders, and not from the psychrometric set from which the relative humidity, dew point and vapor pressure are calculated by the use of tables.

The first step made to get the available data in usable form consisted of tabulating the number of days having maximum temperatures of 85°, 90°, and 100° + over a series of years, totaling each series and averaging them. It was found that the number of days with 90° + readings for a given year was proportional to the sale of ice for that year (for the period before mechanical refrigerators came into wide use). The average of the 90° + series was taken as a "normal" or 100% year. In Texas, the largest sales of ice were made in 1925, which was 133% to 125% of a normal year. The year 1929 was a "normal" or 100% year and the year 1919 was a "subnormal" or 60% year.

†Mechanical Engineer, Fort Worth, Tex.

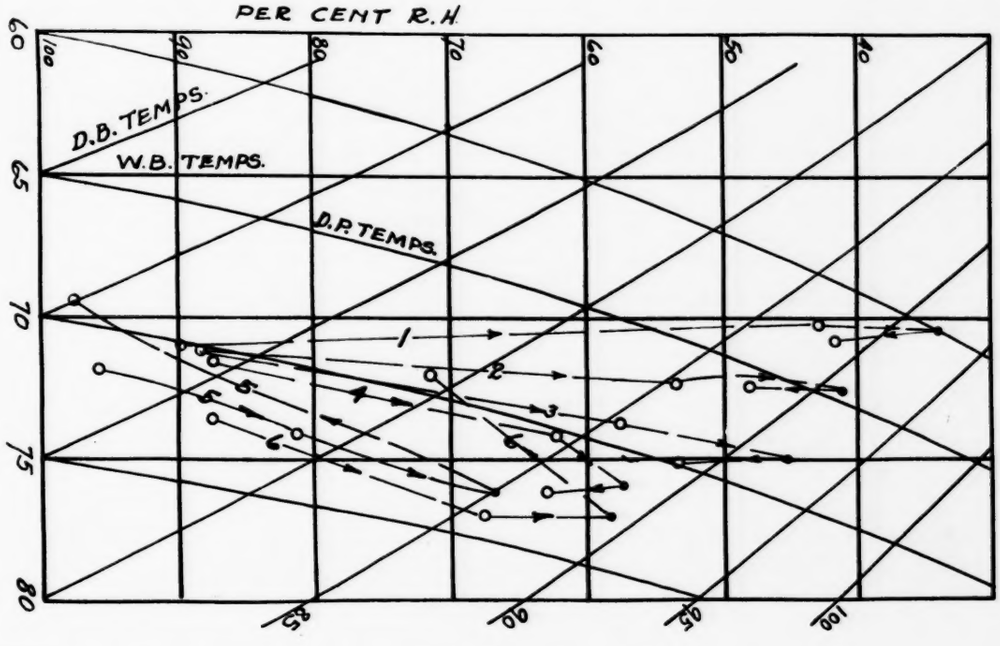


Fig. 1

"Normal" or 100% years as tabulated for several localities are:

San Antonio,	4.6	days	100° +	from	April to September
	111.	"	90° +	"	March to October
Austin,	18.	"	100° +	"	May to October
	119.	"	90° +	"	March to October
Fort Worth,	12.6	"	100° +	"	April to September
	95.	"	90° +	"	March to October
Dallas,	8.	"	100° +	"	May to September
	89.5	"	90° +	"	March to October
Shreveport,	6.5	"	100° +	"	June to September
	87.	"	90° +	"	March to October
Oklahoma City	11.6	"	100° +	"	June to September
	71.7	"	90° +	"	March to October

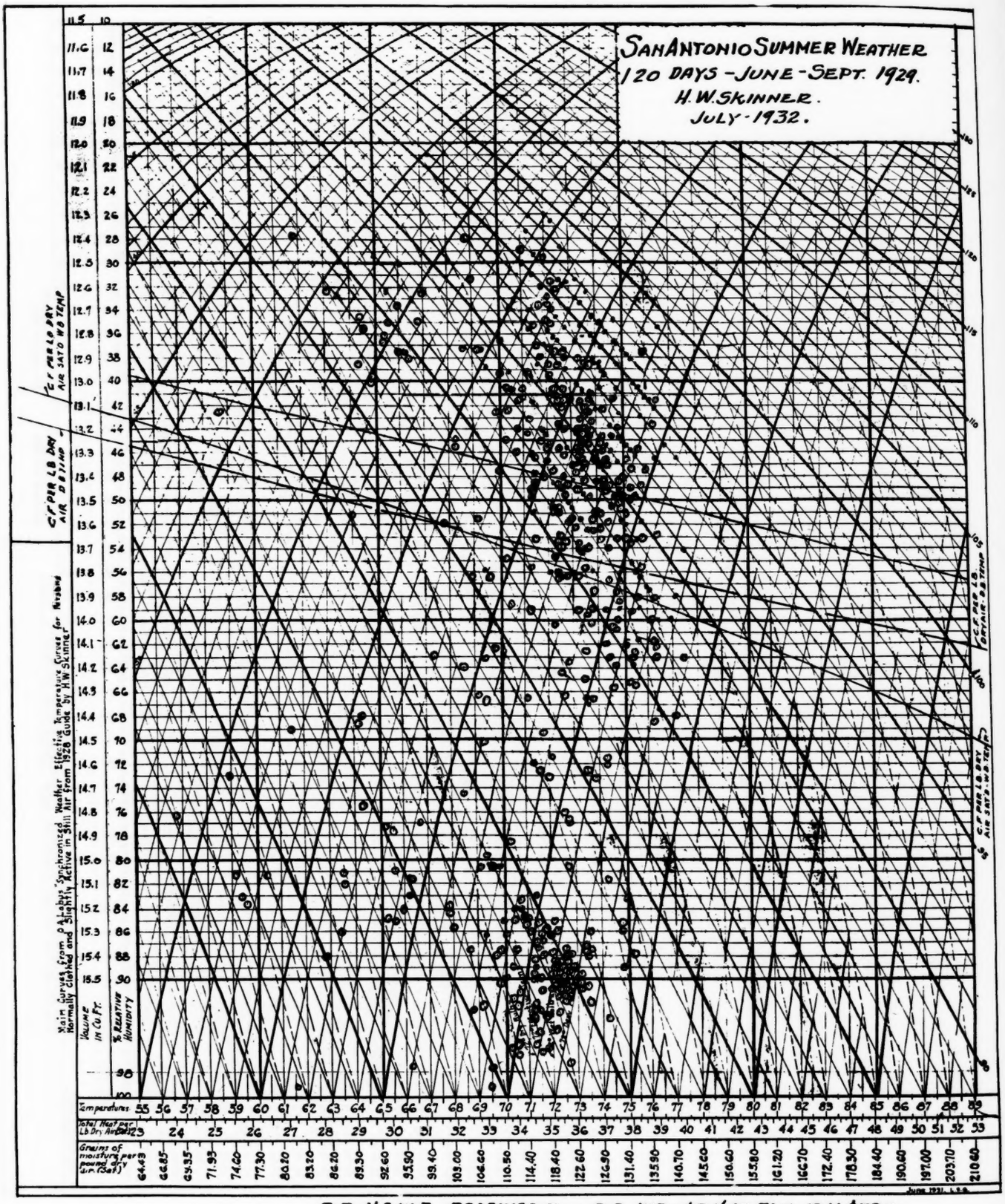

SAN ANTONIO SUMMER WEATHER
120 DAYS - JUNE - SEPT. 1929.
H. W. SKINNER.
JULY - 1932.
Main curves from "Synchronized Weather Effective Temperature Curves for Normally Clothed and Slightly Active in Still Air from 1928 Guide by H.W. Skinner"
G.T. PER LB. DRY AIR SATD. W.B. TEMP.
G.T. PER LB. DRY AIR BEHIND
VOLUME IN CU. FT.
% RELATIVE HUMIDITY
Temperatures
Total Heat per Lb. Dry Air
Grains of moisture per pound dry air (Sat.)
O = U.S.W.B. READINGS FOR D.B., W.B., & R.H. AT 7 A.M., 12 M & 7 P.M.
• = EST'D. W.B. AT U.S.W.B. READING FOR MAX. D.B. FOR EACH DAY.

Fig. 2

Making a tabulation according to months and showing the average number of days 90° + for these cities, we have:

	San Antonio	Austin	Dallas	Fort Worth
May	7.6	9.2	3.6	4.9
June	20.	21.5	17.	18.
July	26.9	27.6	25.4	25.9
August	29.1	30.	25.1	25.7
September	19.	21.3	15.4	15.4
October	4.85	6.3	1.8	3.2

This table shows the peak coming in July and August, and indicates that the conditioning load will fall off rapidly with only occasional days in the month of October, with some in March and April. It is also to be noted that cooling may be required some years in every month even in winter, but such may be expected of the weather — in Texas.

Local conditions are thought to affect the dry bulb readings mainly, but wet bulb readings can be affected should the Weather Bureau station be to the windward of rivers, lakes, cooling towers, etc., when the readings are being taken, thus causing a local variation that would not be noticeable at points out of the path of such disturbing influences.

Using the Labus psychrometric chart as shown in the March, 1932, issue of HEATING AND VENTILATING as a basis of recording the readings from the Weather Bureau, an interesting picture of what the outside weather tendencies are, can be shown, and allows a better estimate of the simultaneous wet bulb for the maximum dry bulb record. This is done by the use of colored pins set for the three readings available, so that from their location on chart and a knowledge of the maximum dry bulb reading, a good estimate may be made to establish the corresponding wet bulb temperature.

Table 2 shows such readings for six days, the readings being selected so as to avoid too much congestion and still show the main idea and the general trend of more complete readings. Fig. 1 shows these readings as plotted, the connecting dash lines and arrows indicating the sequence of readings at 7 a.m., noon, maximum for the day, and 7 p.m.

In Fig. 1 it will be noted that record 1 slopes to the left of the vertical or wet bulb line, while record 2 slopes to the right, the latter three readings being in essentially a straight line, with the estimated maximum also being on an extension of this line. Other maximum readings have the estimated wet bulb shown as an average between the noon and the 7 p.m. readings, allowing some variation due to the hour when the maximum occurs. Curves 3 and 4 are more nearly typical of the numerous records plotted, sloping up slightly to the left of the dew point lines, with the 7 p.m. generally showing somewhat higher wet and dry bulb temperatures than obtained at noon.

Curves similar to 5 and 6 are frequently encountered in plotting readings, and are found all over the chart.

Fig. 2 shows the complete chart covering readings for 120 days in June, July, August and September for the year 1929, showing that the morning conditions are well concentrated around 74°–75° dry bulb, 71°–73° wet bulb, with the noon and 7 p.m. readings covering more territory but still indicating a concentration around 90° dry bulb and 73° wet bulb.

In both Figs. 1 and 2, recorded readings are shown by circles and estimated wet and dry bulb readings are shown by solid dots. While a visual assumption may be made from Fig. 2 as to the proper outside conditions to be assumed, it is the writer's personal opinion that an arithmetical count is more desirable in making this determination. Such a count is shown in Table 3, showing that 95° dry bulb covers 94% of the readings and 76° wet bulb covers 95% of the readings, corresponding to a 41% relative humidity. From the table, it will be noted that 21.2% of the readings show a lower relative humidity.

On a similar basis, the writer believes that the proper assumptions for the other cities referred to hereinbefore should be:

TABLE 1—SUGGESTED OUTSIDE CONDITIONS TO BE ASSUMED FOR AIR CONDITIONING DESIGN IN THE SOUTHWEST

	Dry Bulb Temperature, Deg.	Wet Bulb Temperature, Deg.
San Antonio	95	76
Austin	96	75.5
Fort Worth	101	74
Shreveport	98	76
Oklahoma City	99	75

Comparisons of 100% years with maximum, or 133%, years, show that the maximum years have more hours per day of the higher temperatures, higher maximum for each day, but the wet bulb will be somewhat lower, making the assumptions for a 100% year the proper basis for design of air conditioning plants.

TABLE 2—DATA FROM WEATHER BUREAU RECORDS SHOWN IN FIGURE 1.

Curve No.	7 AM DB	7 AM WB	7 AM RH	12 M DB	12 M WB	12 M RH	Max DB HRS	Max DB DB	Max DB WB*	7 PM RH*	7 PM DB	7 PM WB	7 PM RH
1	73.4	71.2	90	87.2	70.3	43	4	92	70.5	34	88.4	70.9	42
2	73.9	71.4	88	85.1	72.2	53	4	91	72.7	41	87.7	72.5	48
3	73.8	71.3	88	85.4	73.9	58	5	92	75.0	45	88.7	75.1	53
4	74 5	71.6	87	84.2	74.3	62	4–6	88	76.0	57	86.3	76.2	63
5	72.8	71.9	96	78.6	74.2	81	3	85	76.2	67	70.0	69.5	98
6	76.5	73.7	87	85.7	77.1	67	1	89	77.2	58	79.0	72.1	71

**Estimated values.*
DB—Dry bulb temperatures
WB—Wet bulb temperatures
RH—Relative humidity

TABLE 3—TABULATION OF READINGS SHOWN ON FIGURE 2, FOR SAN ANTONIO, TEXAS.

Item		Degrees	Readings	Total	Cumulative Percentage
WB	Up to	70	60		
		71	28	88	18
		72	68	156	32
		73	99	255	53
		74	86	341	71
		75	75	416	87
		76	41	457	95*
		77	18	475	99
	Over	77	5	480	100
DB	Up to	75	100	100	20
		80	45	145	30
		85	47	192	40
		90	141	333	69
		91	31	364	76
		92	30	394	82
		93	20	414	86
		94	20	434	90
		95	18	452	94
		96	16	468	97*
	Over	96	12	480	100
RH	Up to	41%	102	102	21.2*
		50	114	216	45
		60	85	301	63
		70	41	342	71
		80	21	363	76
	Over	80%	117	480	100

**Selected values for outside conditions.*

The Relation of Climate to Air Conditioning Design‡

By OTTO W. ARMSPACH†

MANY of us are not fully aware of the varied climates existing in the United States. It is not easy to believe that many places in the tropics never experience temperatures as high as those regularly recorded in this country. In Phoenix, Arizona, the mean dry bulb temperature for July is 90.5°, whereas at Colon in the Isthmus of Panama lying in the heart of the tropics a temperature of 90.5° is extremely unusual and 92° is the highest recorded over a period of years. The highest outdoor air temperature ever recorded anywhere was not on or near the equator, but near Death Valley, California, where a temperature of 134° was obtained on a properly shielded and tested thermometer. Outside of the United States, the highest temperature recorded at a recognized station is 127° in Algeria.

As a whole the United States has a temperate climate. The country extends over approximately 24° of latitude, and this fact, together with the presence of several mountain ranges and variations in altitude, results in a large variation in climatic conditions. In San Francisco, the mean dry bulb temperature for July is 57.3° F., in Phoenix 90.5°, in New York 73.5°. A similar variation is experienced in passing from the northern states southward. The mean dry bulb temperature for July in Chicago is 72.3°. The temperature rises more or less uniformly in passing southward, reaching a July mean of 81.3° in New Orleans. There is a like variation in wet bulb temperatures encountered throughout the country with a minimum mean for July of 52.6° F. in Lander, Wyoming, and a maximum mean of 77° at Galveston, Texas. These extremes in temperatures emphasize the fact that correct and economical design of air conditioning systems demands a comprehensive understanding and proper interpretation of temperature readings obtained by the Weather Bureau stations.

‡Presented before the Spring meeting of the American Society of Refrigerating Engineers, June 9-11, 1932, Cambridge, Mass.

†Carrier Engineering Corporation

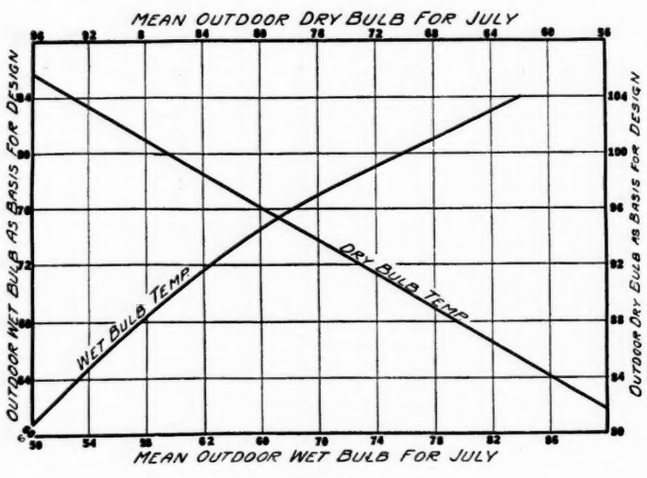

MEAN OUTDOOR DRY BULB FOR JULY
OUTDOOR WET BULB AS BASIS FOR DESIGN
OUTDOOR DRY BULB AS BASIS FOR DESIGN
WET BULB TEMP.
DRY BULB TEMP.
MEAN OUTDOOR WET BULB FOR JULY

Fig. 1

Outdoor Conditions as Basis for Design

It is commonly assumed that the outdoor wet and dry bulb temperatures affect only the tonnage of the refrigerating equipment. This assumption, however, is in error and it is the purpose of this paper to consider other parts of air conditioning equipment design which depend directly upon the outdoor conditions.

The heating system is not based on the minimum outdoor temperature for the heating season, but on a point approximately 15° F. above the lowest recorded, and similarly a cooling system should not be based on extreme temperatures, as these occur during a comparatively few days only. Neither is the mean summer temperature for the hottest month the correct basis, since in that case equipment would be inadequate during a considerable portion of the time. The monthly mean temperature, however, does offer a satisfactory starting point for establishing the correct basis for the design. The month having the highest mean temperature is usually July, and the wet bulb and dry bulb temperatures to be used for the design will be at some point between the mean and the maximum temperatures for the month. The number of degrees to be added to the mean is determined by the mean. As the mean temperature rises, the difference between the mean and the design temperature approaches the maximum temperature, then the daily variation from the mean approaches zero. For example, if we assume that for all practical purposes the maximum wet bulb temperature recorded in the United States is 84°, then if any locality had a mean wet bulb temperature of 84° there would be no daily variation above or below the mean, and the correct basis for design would equal the mean wet bulb temperature.

The July mean wet bulb for San Francisco (Table 1) is 54.3°, and referring to Fig. 1, the wet bulb temperature to be used in designing the air conditioning system is found to be 65°, or 10.7° above mean wet bulb temperature. Similarly, the July mean wet bulb temperature for Jacksonville, Florida, is 75°, calling for a design temperature of 79.7°, or only 4.7° above the mean as compared with 10.7° for San Francisco. A graduated scale of wet bulb temperature increases above the mean has been established to obtain the wet bulb curve shown in Fig. 1.

The outdoor dry bulb temperature to be used as the basis for design has been established in a similar manner with the practical maximum at approximately 125°,

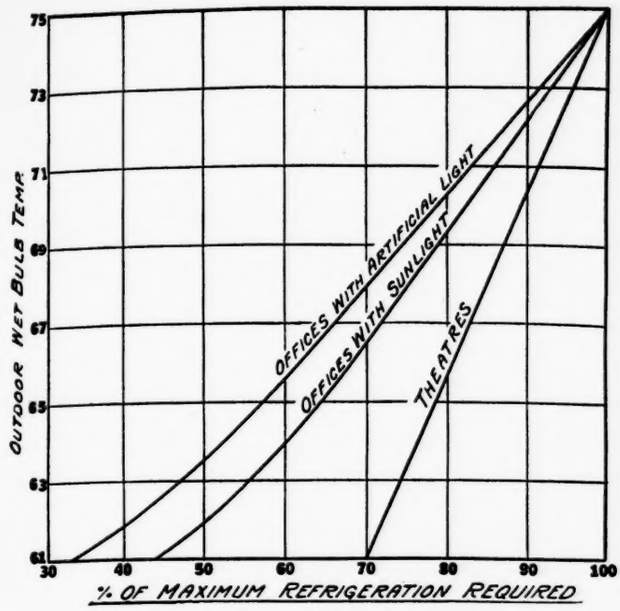


Fig. 2. Effect of outdoor temperature on refrigerating capacity

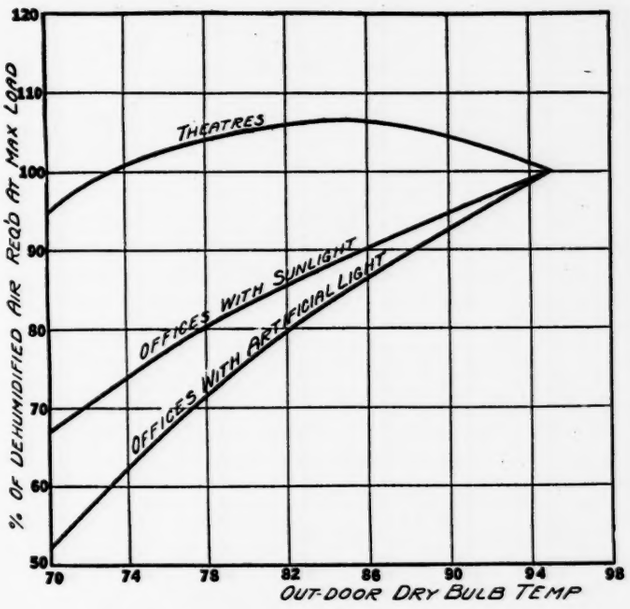


Fig. 3. Effect of outdoor temperature on dehumidified air required

and with an increasing deviation from the mean as the mean dry bulb temperature decreases. For San Francisco, the design dry bulb temperature corresponding to a mean of 57.3° is 82.6°, or an increase of 25.3°, and for Jacksonville with a mean dry bulb of 80.9°, the design dry bulb should be 96.8°, an increase of 15.9°.

Fig. 1 with Table 1 may be used as a convenient and consistent method of selecting the outdoor wet and dry bulb temperatures for air conditioning computations.

Effect on Refrigerating Capacity

The total load on an air cooling plant may, to advantage, be divided into the internal load and the climate load. Such factors as heat from lights and heat and moisture from occupancy constitute the internal load, while the climate load varies with the sun intensity and outdoor wet and dry bulb temperatures. When the outdoor temperatures equal the corresponding indoor temperatures and the sun is not shining, the climate load approaches zero. On the other hand, the internal load is practically constant irrespective of the outdoor conditions.

Fig. 2, based on a maximum wet bulb temperature of 75.0° and a maximum dry bulb temperature of 95.0°, shows the effect of a drop in outdoor wet bulb temperature on the refrigerating capacity required to take care of the internal load for theaters and office buildings. These two types of spaces have been selected as illustrating the essential difference between internal and climate loads and their effect on operating costs. A theater load is largely an internal load, and the reduction in cooling effect required is much less than the office building where the internal load is relatively small. In theaters, the reduction in tonnage as the weather becomes cooler is not so much as might be expected, and even when the outdoor wet bulb temperature falls as low as 61° still 70% of maximum capacity is required.

Rooms in an office building having a northern exposure require only 33% of maximum capacity when the outdoor wet bulb temperature falls to 61°. A room heavily insulated and without windows would require approximately 100% of maximum capacity, regardless of the outdoor conditions, and the curve for such a construction would accordingly fall to the right of the theater curve. The maximum capacity required in this case would, of course, be less than for a more normal construction, but the percentage of maximum capacity required with a falling outdoor temperature would be greater.

Effect on Dehumidified Air Required

An assumption is often made, incorrectly, that the maximum volume of dehumidified air is required when the outdoor temperature is maximum. Further, that with falling outdoor temperature, a reduced volume is necessary to maintain the desired conditions. Such assumptions, if applied to all types of installations, might lead to serious error in design, with the result that some parts of the equipment would be over-sized and others under-sized. On the contrary, for some installations an increased amount of dehumidified air is required when the outdoor temperature is below that for which the equipment is designed. The effect is shown in Fig. 3. It is again assumed that the maximum outdoor dry bulb temperature is 95° with a wet bulb temperature of 75°, and that the maximum load occurs at these temperatures. Also, when the outdoor temperature is 95°, the conditions in the offices will be 80° and 50% relative humidity and in the theater 80° dry bulb and 55% relative humidity. The volume of dehumidified air at maximum load is taken as 100%. Then as the outdoor temperature drops, note that in a theater the cold dehumidified air required increases until an outdoor temperature of approximately 82° is reached. At this point, 7% more dehumidified air is required than was necessary at 95°. Below 82°, the volume gradually decreases until, at 73°, it is again equal to that required at 95°. It is interesting to observe that there is a total variation of only 12% in the amount of dehumidified air required

in a theater installation to take care of all fluctuations in outdoor temperatures, assuming, of course, that the indoor load remains constant.

Curves for installations in restaurants, department stores, ballrooms and the like would have characteristics similar to the curves for theaters. Other applications, such as those for offices, would result in curves falling below that shown for theaters, with the exact location of each determined primarily by the ratio of internal load to total load. Obviously a design based only on maximum load conditions would be correct.

Effect on Cold Water Temperature

One of the most important effects of a change in outdoor temperature is the change in the required dew point temperature of the air leaving the dehumidifier. Many designers carelessly disregard this effect entirely and base the design only on the maximum load conditions. A more careful study would reveal that air leaving the dehumidifier at its lowest temperature is required during cool weather. On the warmer days the temperature of the dehumidified air should be considerably higher. This effect is all the more significant when considered along with the theater curve in Fig. 3, and we are led to the conclusion that the maximum amount of dehumidified air at its lowest temperature is required at considerably less than maximum load. Fig. 4 shows the cold water temperature curve for an office installation. The design is based on an outdoor dry bulb temperature of 95° and a wet bulb of 75°. At this maximum load condition, an office with sun exposure would require air leaving the dehumidifier at approximately 57°. It should be pointed out, however, that this temperature of 57° would not necessarily apply to all office installations, as the correct temperature would be determined entirely by the nature of the internal load and the maintained conditions. As the outdoor temperature falls, the dehumidified air temperature must approach 50° if proper conditions are to be maintained.

Not only the volume, but also the temperature of the air leaving the dehumidifier, must be accurately determined if the system is to be correctly proportioned throughout. The required temperature should not be assumed, nor should it be taken for granted that the

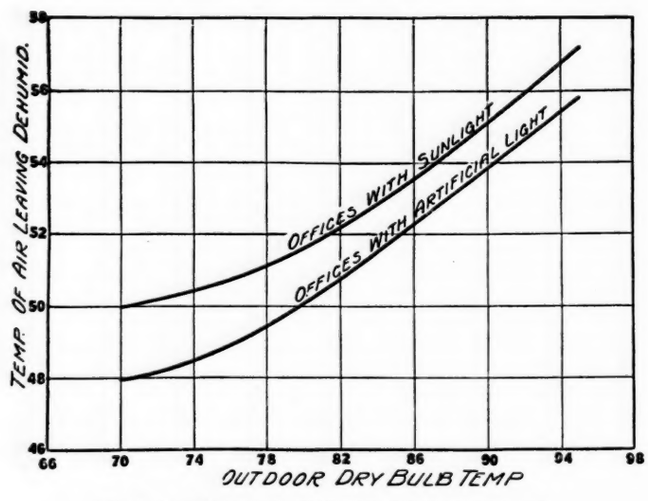


Fig. 4. Effect of outdoor temperature on cold water temperature

Table 1. Mean Outdoor Temperatures for July for Various Cities

State	City	Dry bulb temp. °F.	Wet bulb temp. °F.
Alabama	Mobile	80.5	75.5
	Birmingham	79.8	73.3
Arizona	Phoenix	90.5	68.5
	Tucson	91.0	71.0
Arkansas	Little Rock	80.0	73.0
	Ft. Smith	80.5	72.5
California	San Francisco	57.3	54.3
	Sacramento	72.4	60.6
	Los Angeles	67.4	61.6
	Red Bluff	82.1	62.0
	San Diego	66.9	62.4
Colorado	Denver	71.8	57.8
	Colorado Springs	67.9	56.4
Connecticut	New Haven	71.9	65.9
Delaware	Wilmington	74.0	67.0
D. C.	Washington	76.8	69.3
Florida	Jacksonville	80.9	75.0
Georgia	Atlanta	77.6	69.6
	Savannah	80.5	75.0
Idaho	Boise	84.0	61.0
	Pocatello	85.2	63.0
Illinois	Chicago	72.3	65.8
	Springfield	76.1	68.0
Indiana	Indianapolis	76.4	68.0
Iowa	Des Moines	75.0	67.0
	Keokuk	77.0	69.0
Kansas	Dodge City	77.7	66.7
	Wichita	78.3	69.5
Kentucky	Louisville	78.6	69.6
Louisiana	New Orleans	81.3	75.3
Maine	Augusta	59.8	56.0
	Portland	68.0	62.0
Maryland	Baltimore	77.3	69.6
Massachusetts	Boston	71.3	64.8
Michigan	Detroit	72.1	65.1
	Marquette	64.9	59.0
Mississippi	Jackson	84.0	77.0
	Vicksburg	80.4	74.4
Minnesota	Duluth	66.0	60.0
	Minneapolis	75.0	63.0
Missouri	Kansas City	76.9	68.9
	St. Louis	79.1	70.6
Montana	Butte	76.0	64.0
	Helena	66.9	53.4
Nebraska	Lincoln	79.0	69.0
	Omaha	76.5	66.5
New Jersey	Atlantic City	72.5	69.0
	Trenton	70.0	63.0
New Mexico	Santa Fe	68.7	55.2
New York	Buffalo	70 2	64.0
	New York	73.5	67.0
North Carolina	Charlotte	77.8	70.3
	Wilmington	78.7	73.7
North Dakota	Bismarck	70.2	61.2
Ohio	Cincinnati	77 7	68.7
	Cleveland	72.5	65.8
Oklahoma	Oklahoma City	79.0	70.0
Oregon	Portland	66.3	58.0
Pennsylvania	Philadelphia	75.8	67.8
	Pittsburgh	74.6	67.1
South Carolina	Charleston	81.3	75.3
South Dakota	Huron	71.6	63.6
Tennessee	Memphis	80.7	72.7
Texas	El Paso	80.5	64.5
	Galveston	83.0	77.0
Utah	Salt Lake City	76.2	58.2
Vermont	Burlington	68.2	63.2
Virginia	Lynchburg	77.3	69.8
Washington	Seattle	63 3	56.3
West Virginia	Huntington	76.0	68.0
Wisconsin	Milwaukee	69.7	64.7
Wyoming	Lander	66.6	52.6
Porto Rico	San Juan	79.9	75.2
Bermuda	Hamilton	78.7	74.7

job is a "typical" one. There are no typical installations in air conditioning design. Each proposed installation must be carefully analyzed. A dehumidifier tem-

perature calculated from an assumed volume, or a volume calculated from an assumed temperature, can be no more accurate than the assumptions. Many designers calculate the refrigerating capacity by using the temperature of the air leaving the dehumidifier. This practice often results in serious errors in the design. The tonnage required to maintain a given indoor temperature and relative humidity is entirely independent of the temperature of the air leaving the dehumidifier and it should, in no case, be calculated from this temperature.

The upper curve in Fig. 4 shows a variation in cold water temperature of approximately 7° for outdoor dry bulb temperatures ranging from 70° to 95°. Each point on this curve calls for a different weight of air. Hence, it is impractical to calculate the tonnage from any assumed dew point temperature, unless the correct weight of the air is associated with this temperature. If the volume of dehumidified air handled is calculated by the use of the minimum temperature, namely 50°, instead of the maximum temperature, then the fan capacity and duct sizes are inadequate. The error could be compensated for by installing excess refrigerating capacity. This procedure, however, is not desirable, as it results in a continuous avoidable increase in operating cost, due both to the increase in tonnage and to operation at a reduced cold water temperature.

A similar misproportioned design results when the calculated dew point temperature at the dehumidifier is reduced in an endeavor to compensate for the rise in dry bulb temperature of the air passing through the fan and distributing system. Actually, the readjusted dew point temperature required to offset this rise in temperature is above and not below the calculated temperature.

Effect of Air Supply Temperature

Another element of design which is a function of the outdoor air temperature is the temperature at the point of introduction to the conditioned spaces. Whether in the theater, office, store or restaurant, this temperature, together with the method of air introduction, must receive careful consideration if the best possible distribution is to be obtained. It would seem that with a reduced outdoor temperature when less heat is conducted through walls and windows to the cooled spaces, that the temperature of the air introduced should rise. In most cases, however, due to the size of internal load as compared to the climate load, the inlet temperature must be reduced when the outdoor temperature falls (Fig. 6). In a theater the air supply temperature falls rapidly until the outdoor temperature drops below 70°. With 95° weather, 69° delivery temperature to the auditorium would be necessary, while with 75° outdoors the air must be introduced at 61°. In an artificially lighted office the supply temperature remains practically constant regardless of weather conditions from all outdoor temperatures above 80°.

The design of the air inlets must be made with proper consideration of not only the maximum load conditions, but minimum load conditions as well, since the latter are often more severe than the former. As the outdoor temperature continues to fall below 70°, the theater curve reverses itself, but it is not until comparatively cold

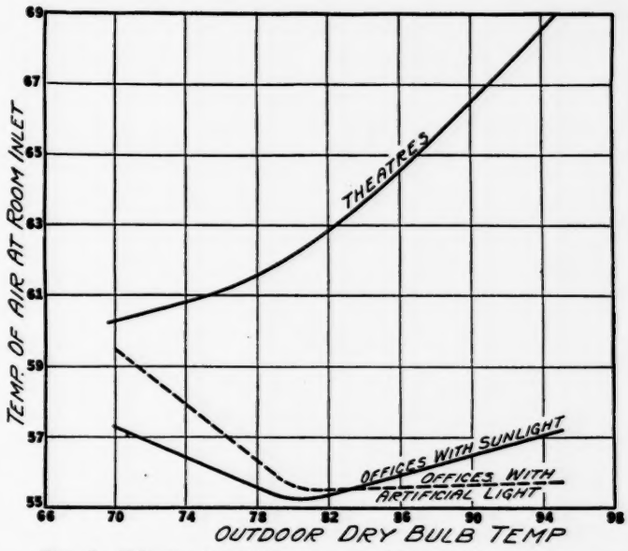


Fig. 5. Effect of outdoor temperature on temperature of air introduced

weather arrives that the inlet temperature reaches room temperature. Above this point supplementary indirect reheating is required. With a full auditorium, there is a cooling load present throughout a considerable portion of the normal heating season. The office curve, owing to a light internal load, reverses at approximately 80°.

Analyses for other types of buildings have curves of similar characteristics, the difference being in the location of reversing point and the point at which the supply temperature corresponds to the room temperature.

Evaporative Comfort Cooling

If air is taken from outdoors and passed through a humidifier capable of producing complete saturation, it will leave the humidifier at a temperature corresponding to the outdoor wet bulb temperature.

To apply this principle of evaporative cooling to cooling for comfort installations, an analysis should be made of the outdoor temperature on one hand and the required dehumidified air and room delivery temperature on the other hand. As pointed out in Fig. 4, the temperature of the air required at the outlet of the dehumidifier varies with the outdoor dry bulb. Therefore, those climates having a large wet bulb depression and at the same time a relatively low wet bulb temperature are most adaptable to evaporative comfort cooling installations.

When the outdoor wet bulb temperature is equal to or lower than the required dehumidified air temperature, then the desired temperature and relative humidity can be maintained in the conditioned spaces without the use of refrigerating equipment. Further, when the outdoor wet bulb temperature is above the required dehumidified air temperature, but below the required room delivery temperature, then the indoor dry bulb temperature can still be maintained with increased volume of air, but the relative humidity will be above that desired.

Many locations in the United States have climates suitable for evaporative comfort cooling, but in cases where such installations are considered, thought should be given to the resulting indoor relative humidities as well as dry bulb temperatures.

Heating and Ventilating a County Home with 123,000 Sq. Ft. of Radiators

(Conclusion)

By FRANK L. WADSWORTH†

NOW we are ready to leave the power plant and proceed through the new tunnel to Unit 2 of the new county home. A 12 in. main carries 20 lb. steam to Unit 2. This is paralleled by a 6 in. high pressure steam main carrying steam at 100 lb. At four points in the tunnel are located three sets of single and one set of double expansion joints, similar to those in the Iola tunnels. The lines are anchored at the point where they leave the power plant and at the entrance to Unit 2.

Inside Unit 2 the lines rise to the basement ceiling and continue down the central passage approximately 150 ft. to the center of the building, with expansion joints midway in the run. At the center of the building the 12 in. line connects into a 12 in. x 12 in. cross, fitted with eccentric reducing flanges. The line is securely anchored at this point.

A 10 in. line extends north into Unit 3, with a double expansion joint midway in the run, and a similar 10 in. line extends south into Unit 4. An 8 in. line extends down to the west end of Unit 2, where it rises to the first story ceiling and continues through the connecting passage to Unit 6. This passage and Unit 6 have no basement. Mains are pitched very slightly and are dripped at regular intervals. At the center of Unit 4 the 10 in. main makes a 90° turn, reduces to 8 in., and continues through the basement to the west end of Unit 4 where it reduces to 6 in. and proceeds through the basement of the connecting passage to Unit 5.

Double expansion joints, located midway in straight runs, are hung from 8 in. H-column sections, fastened between concrete columns similar to those in the Iola tunnel, and the same type of angle supports with guide plates are used. Where longer spans between columns make additional support necessary, inserts are placed in the slab above and a 7/8 in. round rod supports the middle of the span.

The 6 in. high pressure steam main divides at the center of Unit 2 and, reduced in size, is carried alongside the low pressure steam mains, one branch into Unit 3, one west into Unit 2 and through the passage to supply the laundry, and the other into Unit 4 and down to the west end of the basement. Here it terminates with a reducing valve connection into the 6 in. heating main supplying Unit 5, as no high pressure steam is required in the nurses' dormitory except to boost the heating system.

Near the center of Unit 2 a connection for heating that building is taken off the 12 in. main and two

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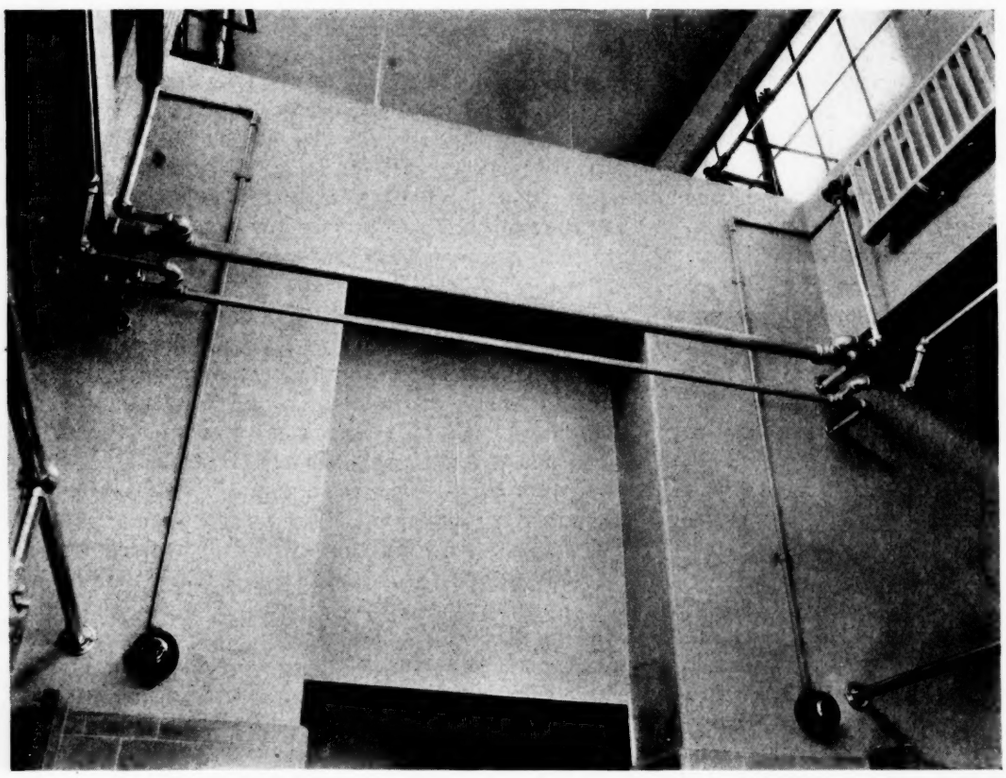


Fig. 5. Skylight radiators in 4th floor, toilet and washrooms, Unit 2. Note that thermal tube between thermostat and valve is concealed in metal molding

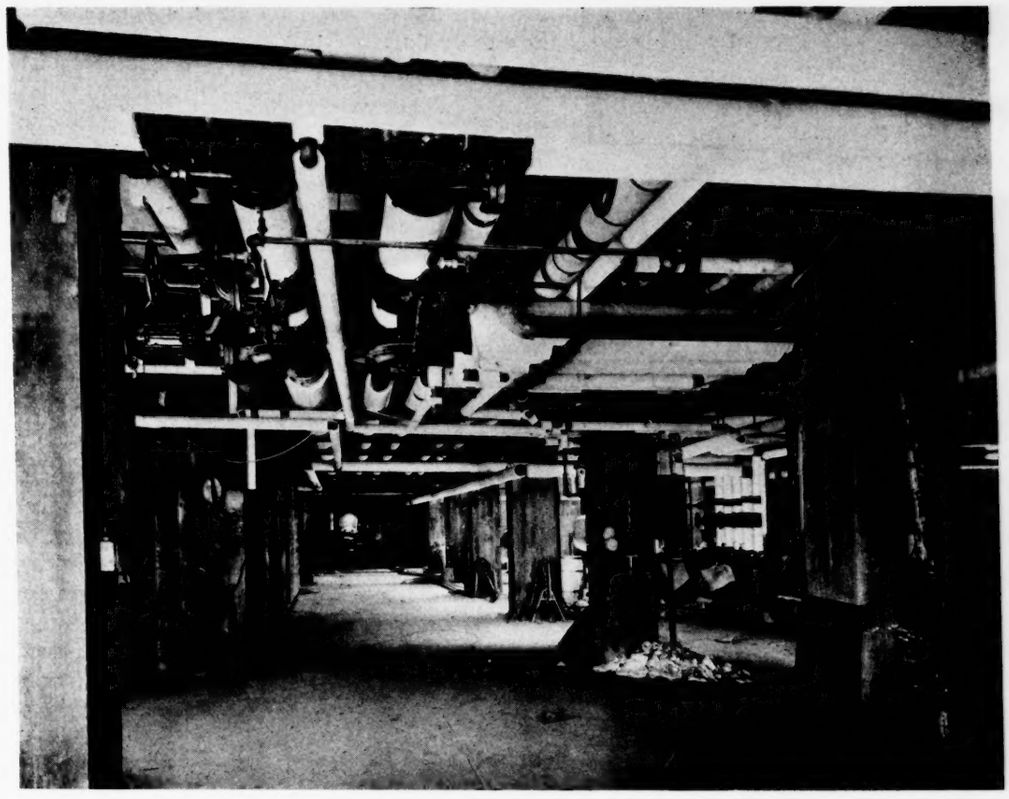


Fig. 6. Basement piping at center of Unit 4. Looking west, passage to Unit 5 in distance, pipe covering not complete. Note suction header of vacuum pumps at right, and reducing valves for Unit 4 at top

reducing valves in parallel are installed. Thus, in mild weather only one is in use, the other being cut in for more severe weather. In addition, a reducing valve connection is taken off the 100 lb. main, so that in case of any accident to the low pressure main, or a shortage of low pressure steam, additional steam is available from the high pressure main. The heating mains for the building are divided into four sections, forming an H, with each section valved. From these mains upfeed risers, each with a gate valve and union in the riser connection, supply the various radiators. With the exception of some concealed radiation in the main lobby, dining hall, and auditorium, all radiation in Unit 2 is exposed standard cast iron tubular and requires no comment.

The basement return mains also form an H and connect to a header near the center of the building where two vacuum pumps and receivers are located. Each of these is rated at 26,000 sq. ft. capacity, to discharge against 40 lb. pressure. The heating supply and return mains in Unit 3 are in the H form with each section separately valved. All radiation in Unit 3 is standard cast iron tubular.

Unit 3 has one vacuum pump and receiver of 26,000 sq. ft. capacity to discharge against 40 lb. pressure. This pump is by-passed, and a by-pass connection is also installed in Unit 2, so that in case of failure of the vacuum pump in Unit 3, the by-pass may be opened and the discharge main then becomes a suction line to one of the two vacuum pumps in Unit 3. The discharge main from the pump in Unit 3 was made larger than necessary so that it could serve as a suction line from the pump in Unit 2, if required.

The service building, Unit 6, is a one-story structure with saw-tooth monitors, and with the exception of offices and bacteriological laboratory is heated with unit heaters hung near the ceiling. If sufficient low pressure steam is available it is used for heating, necessary make-up being taken through reducing valves from the high pressure steam main. In summer, the unit heater fans are operated without steam in the coils to promote air circulation.

High pressure steam, of which the laundry uses considerable, is trapped to flash tanks and again trapped into the vacuum return main. This main is carried in a 12 in. x 18 in. trench with steel floor plates in the ground floor of the service building back to Unit 2, and thence on the basement ceiling of Unit 2 to the vacuum pumps. Normally, one vacuum pump will serve Unit 2 and the other will serve Unit 6, and in case of necessity one pump will serve both.

Passing from Unit 2 through the basement passage to Unit 4 we again find the heating mains in the form of an H, with two reducing valve connections from the low pressure main and one from the high pressure main. We also find a high pressure main served through two reducing valve connections. This main extends the length of the hospital and supplies 10 high pressure steam risers leading up to the various diet and serving kitchens, sink rooms, sterilizer rooms, etc. High pressure returns are trapped at the various pieces of equipment, brought to a basement main which is flashed and again trapped into the vacuum pump suction header.

Radiators

All radiation in the hospital is standard tubular cast iron radiators, wall hung. Radiation is exposed, with the exception of that in the main lobby, which is recessed behind grilles, and in the detention wards, where provisions have been taken to prevent violently insane patients from causing damage or personal in-

jury. Double partitions, consisting of a 4 in. wall, a 6 in. space, and another 4 in. wall, separate the rooms in this section, located on the third and fourth floors. Piping and radiation are concealed within these partitions, and asylum grilles are placed at floor and ceiling levels. A No. 8 gauge removable steel plate, set flush with the plaster in the wall, gives access to the radiator behind for inspection or repairs, while a small hinged door with a lock gives access to the radiator valve. Return mains in Unit 4 run parallel to the steam mains in an H and connect through a suction header to two, 26,000 sq. ft. pumps.

A 6 in. heating main passes through the basement passage into the nurses' dormitory where it is dripped and raised to a loop main extending around the entire basement. The return mains along each side of the building unite into one main, pass back into Unit 4, and connect into the suction header of the vacuum pumps. These are so valved that either pump can serve both Units 4 and 5 together, or one can serve each individually.

Pumps

All vacuum pumps discharge into a common main which passes back into Unit 2 and through the tunnel to the power house, where it rises to the turbine operating floor and empties into the feed water heater. All vacuum return mains are valved, as are also the returns from heavy duty traps taking condensate from the flash tanks for high pressure returns. Thus, in summer, when the heating system is shut down, the vacuum pumps handle only the high pressure returns. All high pressure returns are united and empty into one flash tank centrally located in each building. Owing to the size and length of the low pressure steam mains, the steam flash of the high pressure traps is rapidly condensed and is not noticeable in the buildings as all mains are covered. Heating supply and return risers and radiator connections are not covered except where concealed. The exposed supply risers were left bare and calculated as heating surface.

By arrangement of the return piping and vacuum pumps, a minimum number of pumps are used, and at the same time there is a reasonable factor of safety without excessive duplication of units. For instance, on a cold morning one of the pumps in Unit 2 can be put on Unit 6, while the other takes care of Unit 2. Unit 3 has one pump. In Unit 4, one pump can work on that building and the other on Unit 5. After the buildings are well heated up, one pump in Unit 4 can handle both Units 4 and 5, while one in Unit 2 can handle both Units 2 and 6.

All steam and return mains through the tunnels and central passages, and all steam mains throughout the job, 4 in. and over, are electric welded. Electric welding was specified because faulty welds show up immediately when a test is applied. On large high pressure mains in the power plant welding fittings were used rather than cast iron fittings, except where flanged valves or tees were necessary.

Ventilation

And now a word about ventilation. In Units 2 and 3 the only mechanical ventilation is exhaust fans for the kitchen, bakery, toilets, and locker rooms.

Before final adoption of the exhaust ventilation system without any supply system in the infirmary, a careful study was made of several hospitals. One large and modern institution was found to have both supply and exhaust systems, the supply system taking all outside air which made a heavy steam load in winter. The engineer in charge told the writer that he went through the building and tied light streamers to the supply registers and then very ostentatiously went around with an anemometer measuring the air discharge. Then he showed the anemometer reading to the head nurse, pointed to the waving streamers, and explained how much ventilation they were getting, after which he took the streamers down. The ventilation was pronounced satisfactory.

The next day he slowed the supply fans down, made his rounds, and again was told that the ventilation was OK. This performance he repeated daily for a week, by which time he was not running the supply fan at all, saving all the steam required for the fresh air heaters. The exhaust fans he kept running and found that there was sufficient infiltration through doors and open windows to satisfy the ventilation requirements. He said that the supply fans had not been run in three years and the nurses did not know the difference, while the engineer showed a fine saving in his coal account. In view of such experiences, it was decided to use exhaust ventilation only.

There are 18 exhaust fans in the infirmary. A fan in the basement exhausts 2150 c.f.m. from the isolation ward in the first floor on the southwest wing. This blows through a copper-lined tile flue, plastered outside and extending through the roof. The morgue and autopsy room are ventilated in a similar manner by a 1750 c.f.m. fan, also in the basement.

Three 1600 c.f.m. and one 1800 c.f.m. fans, hung from the sixth story ceiling, ventilate four groups of sink rooms and toilet rooms, located symmetrically on the second to fifth floors, and a couple of 95 c.f.m. fans ventilate two interior first floor toilets. Three other fans on the sixth floor ceiling rated 150 c.f.m., 925 c.f.m., and 700 c.f.m. ventilate the sixth floor fume hood, chemical laboratory, and dark room, respectively.

A 1000 c.f.m. fan in the elevator penthouse ventilates the second, third, fourth, and fifth floor serving kitchens at the west end of the building, and a similar fan, also in the penthouse, ventilates the second, third, fourth, and fifth floor bath rooms at the west end. Two duplicate units perform the same service at the east end of the building.

In the seven-story portion at the center of the building are three more fans, located in a large fan and elevator machinery room. One 3640 c.f.m. fan ventilates a series of locker rooms, toilets, and utility rooms, located above each other near the center of the building, and a similar fan exhausts from the serving kitchens and the smoking rooms.

Lastly, a fan of 8500 c.f.m. capacity exhausts air from a large range hood in the main kitchen on the first floor. This fan, like the others in the serving kitchens, has access doors in the fan housing for cleaning grease accumulations. Metal ducts to these fans are built into the masonry construction, and where branches leave the range hoods to connect to the vertical flue,

Fig. 7. Monroe County Home looking West from East Henrietta Road. Buildings from left to right—Units 4, 2, and 3

fire shutters with fusible links are installed. Fan motors are started and stopped with remote control push buttons.

Siegmund Firestone, Rochester, N. Y., is the architect and engineer in charge of the project, and A. Friederich and Sons Co., Rochester, are general contractors for Units Nos. 1, 3, and 4; Geo. Kircher & Sons for Units 2, and John B. Pike and Son for Units Nos. 5 and 6. Heating contractors for the various units are as follows: Power plant, Warnock & Zahrndt, Inc., Rochester; administration and women's building, Lothar C. Gresens; men's building, Barr & Creelman Company; infirmary building, Bliss Plumbing and Supply Company; nurses' home and service building, Martin W. Utz.

Equipment

The following include only those materials for the new buildings and those installed to enlarge the capacities of the new power plant.

Ash hoppers—Allen-Sherman-Hoff Company.
Boilers—Edge Moor Iron Company.
Boiler feed regulators and governors—Northern Equipment Company.
Boiler feed pumps—Pennsylvania Pump Company.
CO_2 recorders and draft gauges—Hays Company.
Expansion joints—American District Steam and Yarnall-Waring.
Feed water heater—Cochrane Corporation.
Forced draft fans—American Blower Company.
Globe and gate valves—Wm. Powell Valve Company.
Hot water circulating pumps—Gould Pump Company.
Hot water storage heater—The Sims Company.
Main condensers, centrifugal and circulating pumps—Worthington Pump and Machinery Corporation.
Pipe, wrought—A. M. Byers Company, Reading Iron Company, Cohoes Rolling Mill Company, and others.
Pipe, steel—National Tube Company, and others.
Pipe fittings—Crane Company, Walworth Company, Grinnell Company, Inc., and others.
Packing—Garlock Packing Company.
Radiators, cast iron—United States Radiator Corporation, and Weil-McLain Company.
Radiators—Herman Nelson Corporation, and John J. Nesbitt, Inc.
Radiator traps—Warren Webster & Company.
Radiator valves—The Fulton Sylphon Company.
Reducing valves—Ruggles-Klingerman Mfg. Company.
Spray pond equipment—Yarnall-Waring Company.
Soot blowers—Diamond Power Specialty Company.
Stokers—American Engineering Company.
Traps—Armstrong Machine Company.
Turbo-generators—General Electric Company.
Unit heaters—Ilg Electric Ventilating Company.
Vacuum pumps—Nash Engineering Company, and C. A. Dunham Company.
Ventilating fans—B. F. Sturtevant Company.
Welding elbows—Tube-Turns, Inc.

Estimating Steam Consumption Where Less than 70° is Maintained

ROBERT L. FITZGERALD†

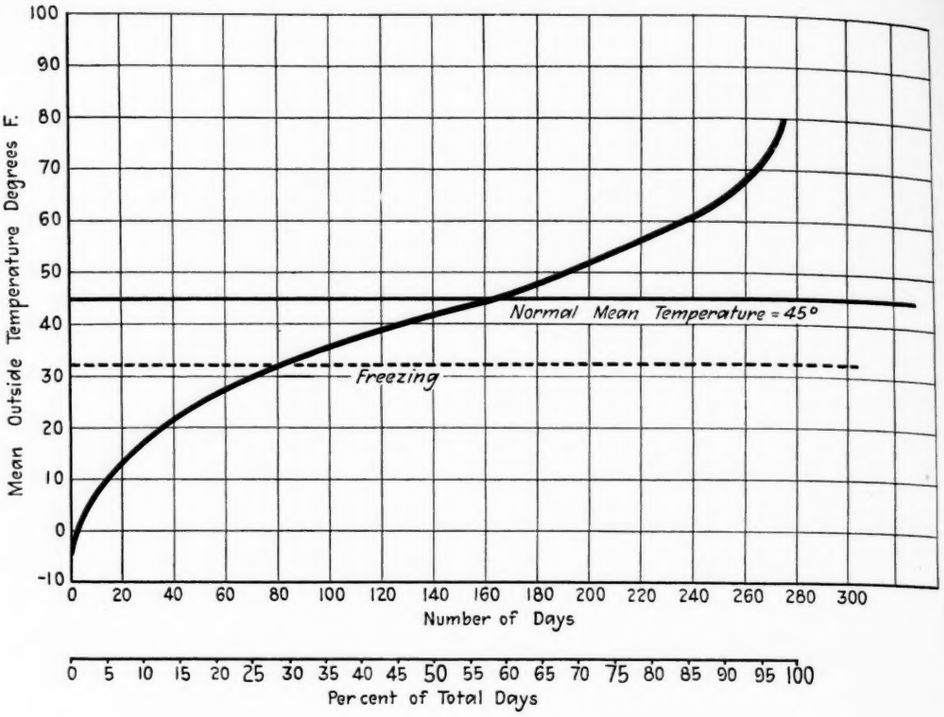
IN these days of diminishing revenues and delinquent rents, operating costs are receiving closer attention. Often it is not only desirable but necessary to determine how close to actual needs various operating expense items are running. Heating costs are one of these operating items.

The data for estimating steam consumption or heating costs, for normal 70° inside temperatures, are easily available and effectively used. However, there are many heating jobs that do not classify under the heading of 70° inside temperature. Included in these are:

The vacant shop or building that must be kept above freezing for fire protection and protection of plumbing.

The storage garage that is satisfactorily heated at a temperature of 40°, or in certain cases 33°.

†Manager, Heating Department, Indianapolis Power & Light Company.



Curve for Indianapolis, season of 1929-30.

The warehouse that is satisfied with any temperature above freezing.

The machine or other shop that is heated when the temperature is 60°, or somewhat below.

The water stand pipe, or roof tank, that supplies the sprinkler system that must be kept from freezing.

In addition to checking existing operation of such jobs, it is often necessary to estimate heating costs of proposed projects that will operate at sub-normal temperatures.

In order to facilitate and improve the accuracy of such estimates, the accompanying temperature duration curve has been plotted.

The curve was compiled for the heating season of 1929-30, a normal heating year. While the curve is exact for this particular year, the data have been compiled for several other normal years, but the variations are so modest that estimates based on this particular curve would be within the accuracy of the estimate as a whole. The curve is plotted for normal weather conditions in Indianapolis and would have to be plotted or adjusted for localities having average temperatures materially different from Indianapolis.

The curve shows at a glance the number of days and the per cent of the normal heating season that steam will be necessary to maintain any given temperature.

The particular instance that provoked the plotting of this curve was the necessity for estimating the amount of steam required to protect a roof tank on a sprinkler system from freezing. Of all types of installations utilizing steam, it seems that the economical use of steam for protecting roof tanks from freezing is the most neglected of all. Most of these installations are made without any temperature control, and where temperature control is installed its maintenance is frequently neglected.

The use of the temperature duration curve in making an estimate of steam consumption for a sprinkler tank would be as follows:

The tank, a 20,000 gal. steel tank, having a heat loss of 140,000 B.t.u. per hr., with an average water temperature of 35° and outside temperature of zero. The heat loss would be equivalent to 560 sq. ft. of direct radiation.

The steam supply would be controlled by two thermostats, wired in series. One thermostat would be submerged just below the upper surface of the water (mounted on a float, if necessary) to be actuated by surface water temperature and set to close at 35°. The second thermostat would be located in a protected position to be actuated by atmospheric temperature and set to operate just above 32°. As these two thermostats are wired in series, the steam is only on when the atmospheric temperature is below 32° and the surface water in the tank is below 35°.

The temperature duration curve shows that the mean outside temperature is below 32° for 80 days in the year. We can divide this up into four twenty-day periods, and obtain the following:

Col. A No. of days	Col. B Aver. temperature, deg.	Col. C Deg. below 32° (32—Col. B)	Col. D Deg. Days (Col. A x Col. C)
20	7	25	500
20	18	14	280
20	25	7	140
20	30	2	40
Total			960

Col. B was obtained from the chart. For example, the second, twenty-day period shows a temperature of 14° at the beginning of the period, and 22° at the close, giving an average of 18° as shown for the second period in the table above.

The heat required per degree temperature difference per day (degree day) will be

$$\frac{140{,}000 \times 24}{35} = 96{,}000 \text{ B.t.u.}$$

Since the total degree days is 960, the total B.t.u. required per year will be $960 \times 96{,}000 = 92{,}160{,}000$. Thus, the job will require 92,160,000/970 or 95,000 lb. of steam per year.

The same installation, without automatic control, would easily consume 400,000 lb. of steam per year, of which 76% would be unnecessary waste.

Steam Meters in the Heating System

Development—Types—How They Work—Selecting a Meter—Installation—Maintenance

By FRED G. AUSTIN

METERS, which we now use so commonly, have reached their present development only as a result of a long period of endless effort.

For many years, the idea of measuring the steam used for heating purposes was not considered. Although steam was sometimes bought and sold, it remained a mystery to the layman. Many engineers were not familiar with the properties of steam. It had never occurred to them that steam could be weighed in practical use.

As early as 1797, Venturi announced that fluids under pressure gain speed and lose head in passing through converging pipes and vice versa for diverging pipes. This gradually became known as Venturi's Law. Clemens Herschel, a hundred years later, conducted tests which proved that a remarkably constant relation exists in a compound tube between the difference in pressure at inlet and contracted section and the rate of flow. Subsequent experiments have shown that other methods of interchanging pressure and velocity also create pressure differentials which bear a definite relation to rates of flow.

Birdsall Holley, who was the first to apply practically underground steam-heating to buildings at a considerable distance from a boiler plant, designed and used the first American steam meter, which was designed after the principle of the present fluid meter. The flow of steam caused a hand to move back and forth on a chart. In 1880 Mr. Holley developed another meter, into which steam was admitted through a nozzle, impinged on a horizontal wheel carrying several vanes, and escaped through a horizontal orifice located in the wheel chamber, to the building heating system. Later on, Thayer and Everett developed a condensation meter which was made up of copper buckets designed in such a way that they recorded the amount of water each time the bucket dumped.

Other meters have gradually been developed as both the demand and knowledge of applicational data have grown. Out of the period beginning in 1877, we now have two outstanding types of meters in common use. They are commonly called the *condensation*, a positive meter, and the *fluid*, an inferential meter. Both of these meter types are in common use, although each has limitations in its application.

Condensation Meters

Condensation meters, which are quantity meters, are available in both dumping and revolving bucket lines, but it is possible to describe only one type here, and that but briefly.

One such meter consists of a cast-iron casing, in which is encased a cylindrical copper metering drum, revolving on roller bearings. The drum is divided into compartments. Water or condensation is admitted by means of a spout introduced exactly at the center of the drum but not connected to it. In the bottom of the spout and extending lengthwise is a slot through which the water passes into the drum.

Due to the shape of each compartment, the center of gravity is constantly moving toward one side as the water fills the compartment. This shifting center of gravity causes the drum to rotate. Each compartment fills and discharges a definite and fixed volume of water once in each revolution. This meter, therefore, measures water volumetrically, and in this respect is similar to an ordinary gallon measure.

The rotation of the drum is transmitted to an integrating counter which registers the total quantity of the liquid that has passed through the meter. This counter is located within a separate housing attached to the meter and is usually calibrated and registers in pounds.

Flow Meters

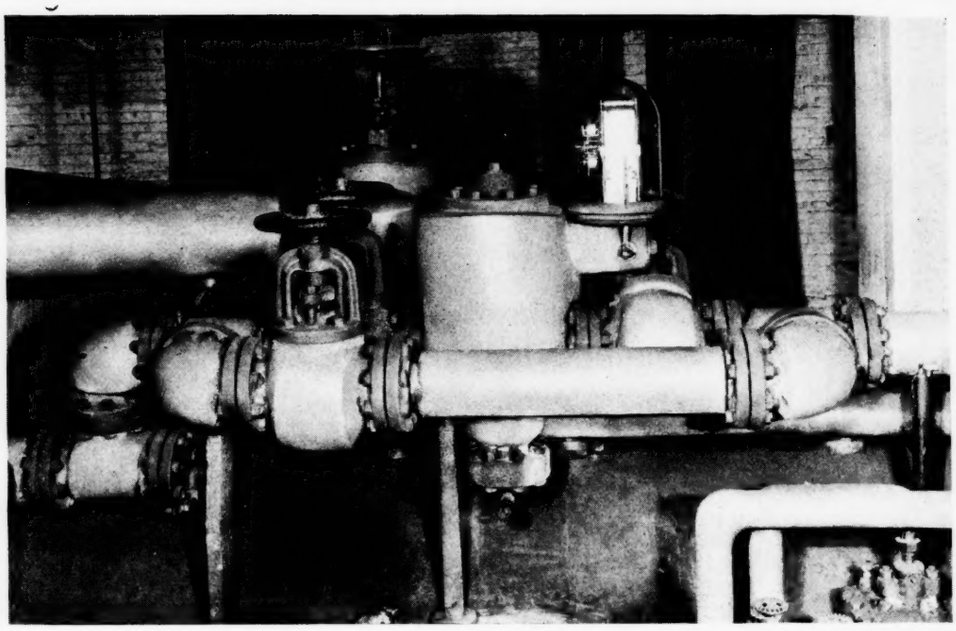
There is a general principle which may be applied to all fluid meters by way of description which will make them more easily understood. All flow meters for the measurement of steam have the common characteristic of being *head meters*. That is, pressure difference or differential head is produced which is then used as an indication of the rate of flow through the primary device, this head depending upon the speed and density of the fluid. This difference may be between the static pressures at two different sections of the stream, as in the Venturi, flow nozzle, and thin plate orifice meters; or, it may be the difference between the static pressures at two points in the same section of a curved stream, as in the centrifugal meter and the flow bend; or, finally, it may be the difference between static and kinetic pressures at the same point, as in the pitot or impact tube meter.

It can be seen from this general principle that there are many different ways of metering the flow of steam in pipes. This has been the cause of the many different designs of flow meters now on the market.

Velocity type meters depend on the creation and measurement of a differential pressure produced by the flowing liquid. In the orifice meter, for example, the differential pressure is produced by placing an orifice in the line of smaller diameter than the pipe itself.

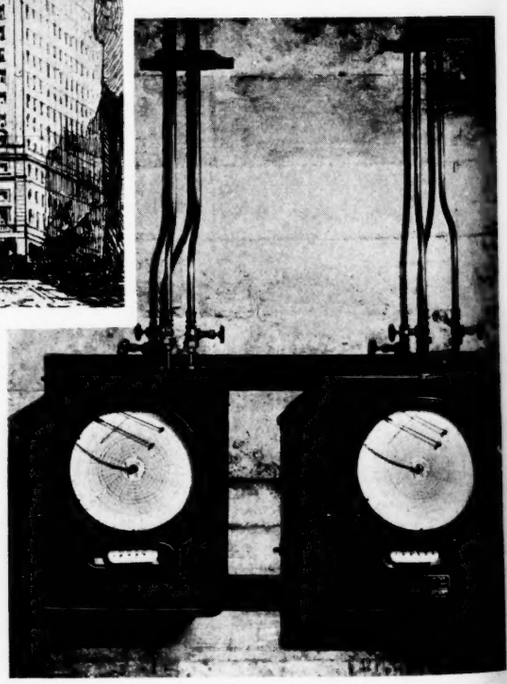
Modern Buildings

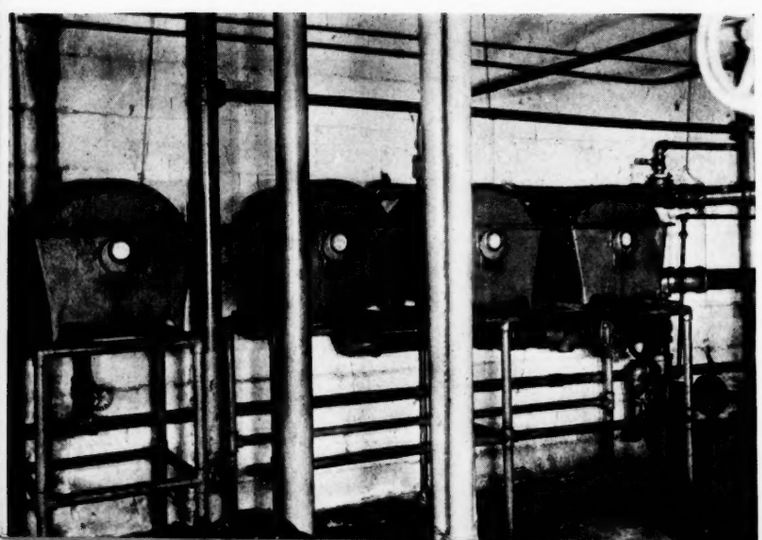
Of all the instruments which guide in the operation of the building is perhaps the most unhonored owners of the buildings pictured advantages in using steam meters, boiler plant or purchases steam



An American District Steam Company St. Johns meter installed in the Pittsfield Building, Chicago. Shown at right, this meter, unlike other types, has a variable orifice. The glass-enclosed device on top houses the recording apparatus. The building, which is part of the estate of Marshall Field, was designed by Graham, Anderson, Probst & White.

The views to the right show the Roosevelt Hotel, New York, and two Bailey fluid meters installed in the hotel to measure the flow and pressure of steam sold to the building by the New York Steam Corporation.

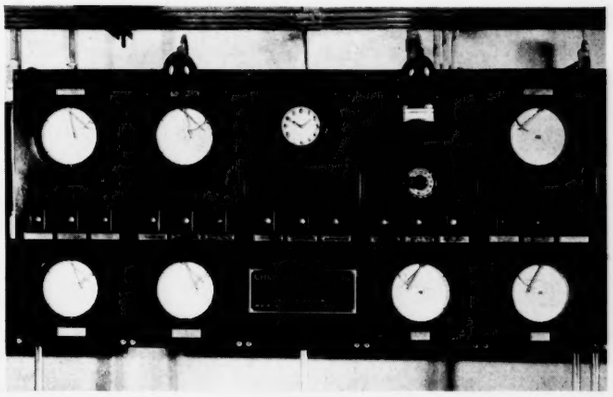




The view to the left shows four American District Steam rotary meters installed in the Michigan Boulevard Garden Apartments, Chicago. The fifth meter is not shown in the photograph. A. C. King was

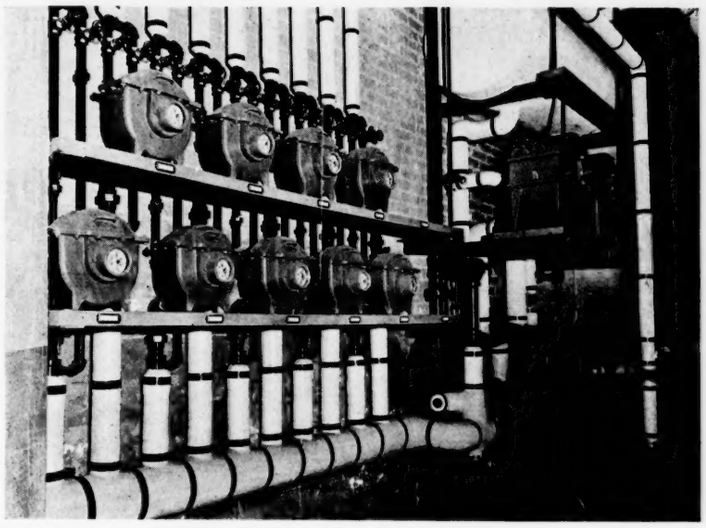
Use Steam Meters

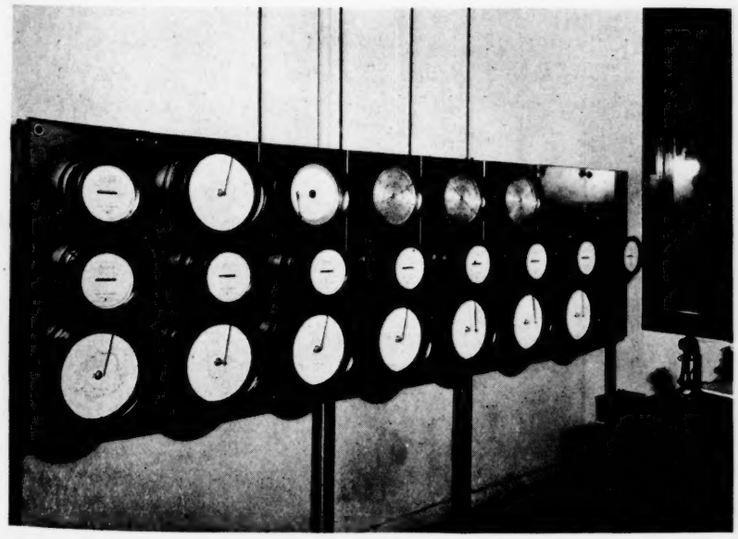
the engineer, manager, and owner heating system, the steam meter and unsung. The designers and on these pages are aware of the whether the building has its own from a utility.



The Chrysler Building is equipped with Brown Instrument Company steam flow meters (above) which inform the engineer just where the steam is being used and to whom the costs should be charged.

The Weatherby Building, Portland, Ore., shown above, has an unusually neat and compact arrangement of condensation meters, as shown to the right, made by the Central Station Steam Company. Note how the return piping, after passing through the meter, runs into a common header.





Central meter board (left) in the chief engineer's office of the Stevens Hotel (below) Chicago. Seven Republic flow meters measure the steam generated by the seven boilers. Large indicators are mounted on the boiler fronts showing the amount of steam being generated by each boiler. These serve as a guide to the fireman in locating overloaded or loafing boilers.

Obviously, the velocity will be greater at the orifice than in the line, resulting in a pressure drop or differential pressure across the orifice plate.

The greatest constriction of the flowing stream is a short distance downstream from the orifice plate and below this point the flowing stream enlarges again to the size of the pipe. Its velocity decreases until it is the same as it was before the orifice plate was encountered and its pressure increases until a large portion of the pressure drop has been removed. The energy apparently lost through friction reappears in the form of super heat or (in the case of wet steam) increases in quality.

In meters using the pitot tube principle, experience has indicated that they are suitable for use where the conditions of flow are reasonably steady. Even in these cases long straight runs of pipe are required preceding the points where pitot tubes are to be used due to the fact that swirling flow affects the accuracy of the pitot tube and any bend or elbow will set up that motion. This type has advantages, however, in that a great deal higher rate of flow may be handled with the same pipe ratio and the same differential. By using a flow nozzle or a multi-hole nozzle in place of the pitot tube, the effect of swirls or eddies will be greatly lessened. However, these are not always accurate, because of the accumulation of sediment around the holes, thus reducing their area. The Venturi tube, flow nozzle, and orifice all operate on change of velocity, while the differential pressure in the case of the pitot tube is due to impact.

Selecting the Meter

It is essential, in selecting a meter for use on a particular job, to investigate the kind of work each meter can do, and the arrangement of the piping where the installation is to be made, in order that the best application may be had, thus eliminating faulty operation.

The following points should be checked carefully in selecting a condensation meter; first, all the returns should be brought back to a common point, second the peak load of the building should be known, and third, arrangements should be made for a reservoir ahead of the meter to keep it from flooding when the building is being warmed in the morning. It should be known whether a vacuum is to be drawn through the meter in order that suitable gaskets can be placed in each open joint. If a vacuum pump is used, it must be known whether it is located ahead of the meter, or whether the condensate will flow by gravity.

In selecting a condensation meter, we should consider its adaptability to the particular job, and, having proved it the correct meter, we should then determine the size. In a great many instances in larger buildings, a battery of meters is installed and the piping arranged in such a way that certain sections of the building can be metered separately. This is done from the standpoint of economy in determining whether there is adequate heating surface installed in the sections metered, or whether there is an over-radiated area causing unnecessary waste of steam.

Recording attachments to make a permanent graphic record of the performance of condensation meters are now available and represent a recent development. In the case of large buildings, the chart may be placed in the manager's office and gives him a record instantly of the heating condition of his building.

Other Factors

After the selection of a particular type of flow meter, there are several factors which should be given careful consideration in order that accuracy and dependability can be assured. It is absolutely essential that the maximum and minimum demand be known, together with the velocity, quality of the steam, and the degree of superheat, in order that the proper sizes may be selected.

Unless a constant load is supplied, it is necessary with some meters to arrange for the removal and change of the orifice plate. In the winter months when the steam demand is heaviest, a larger orifice is inserted and perhaps several changes are necessary during the year, depending upon the operation of the building or the type load. This is an important factor in measuring steam flow accurately. It often accounts for inaccurate records when the maximum and minimum hourly demands are not watched carefully. It is now possible to adjust the size of the orifice without removing any piping.

Shunt Meter

A meter of recent origin is the shunt meter which employs the Venturi principle. It has a wide range of flow without the necessity of complicated calculation, correction or interpolations under ordinary conditions of use. One of the attractive features is its low first cost and ease of installation with low cost of upkeep.

It is evident from a consideration of the efficiency curve of any boiler that the ratio of fuel to steam is not the same at different loads. Therefore, it is obvious that a meter, showing the exact amount of steam generated by the boiler at any moment and calibrated in boiler horsepower or per cent of rating, gives the fireman a continuous picture of the work being done by that boiler. The indicating meter which shows the steaming rate of the boiler is indicative of load changes far in advance of the pressure gauge. Furthermore, a meter on each boiler will indicate which, of a battery of boilers, is lagging behind the rest, and corrective measures may be taken. The use of meters for steam send-out in the boiler plant is as essential as the meter at the point of use.

One point which should not escape attention is that a condensation meter will not yield dependable results if there is a direct loss of steam or condensate, or if conditions make it impossible to collect all of the returns. In the newer types of building, many of the losses which occur in older buildings do not exist, making it possible to measure all of the returns.

The increasing demand for dependable and inexpensive meters has caused manufacturers to carry on extensive study and the result has been the meter of today—an extremely useful device. They are now in such a state that every plant of any size is almost certain to be benefited by their intelligent selection and use.

Air Conditioning a Residence with District Steam

By W. H. RUDISILL†

District steam is used for air conditioning this imposing residence in Coatesville, Pa.

WILLINGNESS on the part of heating and ventilating contractors to attempt to meet the customer's desires and needs, even to the extent of designing and assembling equipment to do this, often results in business that otherwise would never be obtained, and opens up new and lucrative fields of work.

Proper humidification and air conditioning are being talked of and written about until almost everyone is familiar with the terms, though most laymen think of them as things greatly to be desired but as yet almost impossible luxuries, not knowing that when carefully considered they may work out as an economy in actual reduced operating costs. From the standpoint of comfort and health they possess intangible though very real advantages, but when they decrease actual heating bills, reduce work of house cleaning and make comfortable rooms heretofore uncomfortable, then real figures of saving can be produced and substantiated. Practically every warm-air heating system can be modernized, but it takes a willingness on the part of the contractor-engineer to exercise ingenuity and vision to sell the idea.

An installation that illustrates these points has been made in Coatesville, Pa., by the Chester Valley Electric Company. A rather imposing residence was originally heated by three oil-fired systems. One of these was on a hot water boiler supplying the hot water radiation system, the other two units being on combination air and hot water heaters. A coal-fired boiler supplied hot water for domestic needs. Parts of the house were heated with warm air alone, some rooms by hot water radiation alone, while other rooms had both hot water and warm-air registers. Adjacent to each discharge register were discolored spots on the wall paper and tapestry. One thermostat for each of the two combination units controlled their operation and usually the warm-air heated rooms reached the cut-off point of maximum temperature long before the hot water heated rooms reached comfortable temperatures, so they were often too cold or the other rooms overheated.

In this case the electric company operates a district steam heating system and through its steam heating engineers promptly offered suggestions. As a result, two warm-air units heated by steam, with forced circulation of the air, humidifiers and air filters were installed to supplant the original warm-air heat. Forced circulation of filtered and humidified warm air at reasonably low temperatures in winter and of cold de-

†Vice-President and General Manager, Chester Valley Electric Co., Coatesville, Pa.

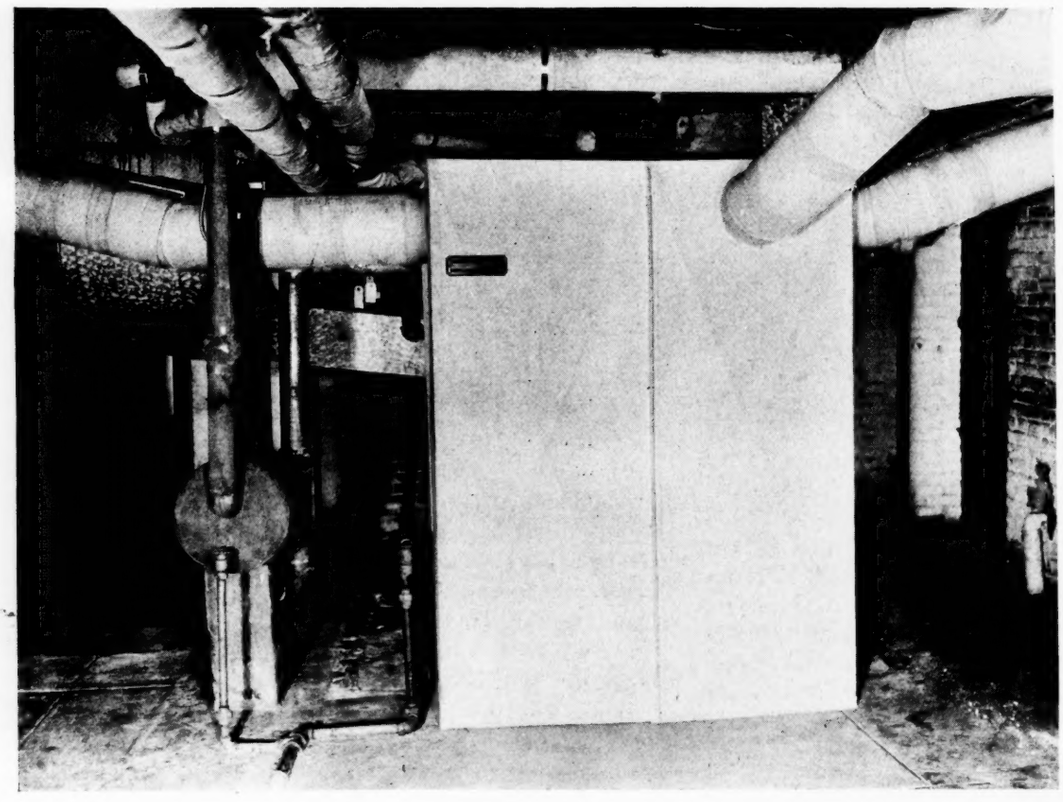
humidified air in summer was arranged. In moderately warm weather no precooling is expected to be necessary. Steam-generated hot water units were installed to take care of the hot water radiation. With the diversity obtained from these four units, thermostatically controlled from proper locations, even temperatures are obtained in every location.

The domestic hot water supply is taken care of by a hot water generator feeding into a large heavily insulated storage tank in which are installed electric heating elements for off-peak operation. The steam condensate from the whole system is used to temper or preheat the water going to the domestic hot water heaters, as an economy measure. In the summer months, when the district steam heating system is not operated, the electric elements in the hot water storage tank automatically come into service, the controlling thermostats on the electric heaters limiting the electric use to such periods when no steam is available. In five rooms of the house, the owner's bedroom, dressing room, bath, small dining-room and nursery, it was desirable to have some heat available for cool summer evenings. Consequently, electric heating elements were built into the warm-air ducts leading to these rooms and controlled by a push-button control station in each room. These control stations have indicating lamps to show when the electric heat is being used. Thus the owner, who is susceptible to slight changes in temperature, can come in from an automobile ride on a cool summer evening and by the touch of the finger instantly secure a flood of warmth through the register so controlled. Also, a small oil-fired hot water boiler with electrically forced hot water circulation, automatically controlled, goes into play for the whole house in case the temperature at any time falls below 70° during the summer when district steam heat is not available. In this way the owner has ideal temperatures at all times coupled with clean, filtered, conditioned air at a very reasonable cost.

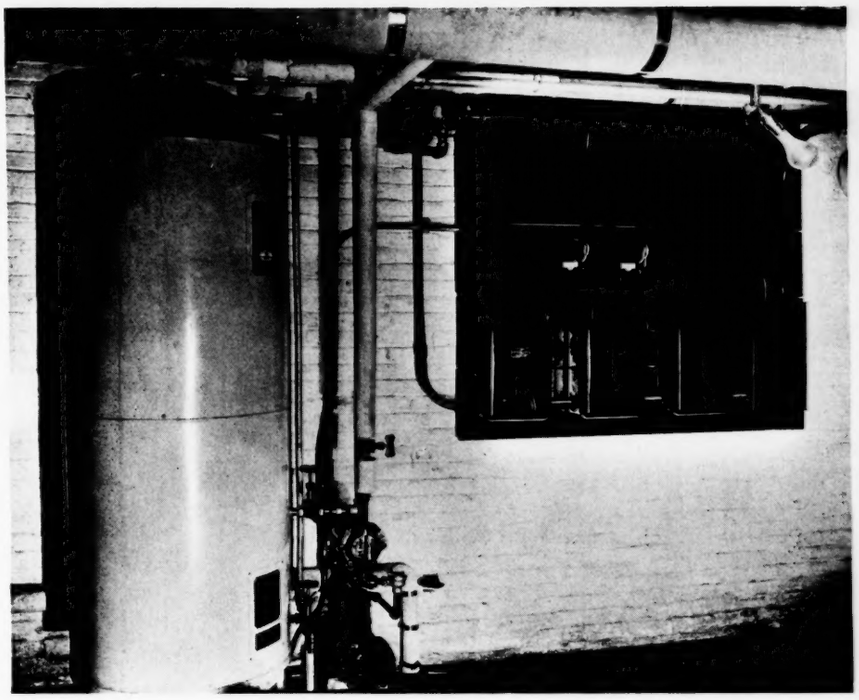
Where district or central steam heat is not available the same results can be obtained by installing an automatically-controlled gas, oil, or coal-fired boiler to produce the steam. The modern country or suburban house, due to its rambling nature, is ordinarily difficult to heat with a central warm-air furnace, but with a central boiler generating the steam to be distributed to a number of properly designed units for providing the warm conditioned air, the problem is easily solved. Such units can be economically arranged for the recirculation of the air and equipped with cooling and conditioning apparatus.

Technically, the installation, though apparently complicated, is simplicity itself. The steam main supplying low pressure steam (8 lb. gauge) runs down the center of the basement ceiling with branch lines supplying the various devices, all piping being well insulated. The two warm-air units were especially designed, each one being made up of a unit heater capable of condensing 205.5 lb. of steam per hour and of delivering 187,000 B.t.u. at the coil, in front of which is mounted a 2400 c.f.m. filter. The fans are designed to give noiseless, positive circulation, drawing the air from the recirculation ducts through the filters and unit heaters and discharging the heated air into the plenum chambers where it is passed over automatic drip humidifiers and then forced through the air ducts into the various rooms.

Each air duct is controlled by a dial-locked damper. The fans are set on sound-absorbing bases connected to the unit heaters in the plenum chamber by heavy canvas joints. They are driven by ½ hp. capacitor type motors through V-belt drives. Thermostats control the motors, no attempt being made to control the steam



One of the conditioning units located in the basement, capable of delivering 187,000 B.t.u. per hr.



Off-peak electric storage heater is used for the hot water domestic supply. The illustration shows the magnetic switches and controls for auxiliary electric heating.

supply, which is wide open at all times except during the summer when the system is used for cooling.

The unit heater coils have connections to receive cold brine in summer from a tank into which scrap and discolored or low-priced ice is dumped to cool the brine. The brine is circulated through the unit heaters and back to the brine tank by small centrifugal pumps driven by the blower motors. Eliminator plates are installed directly after the unit heaters (or coolers, as they act in this case) to remove the condensed moisture. The two air units have ample capacity to take care of the whole building in most extreme weather.

Owing to the fact that only on a few exceptionally hot days will artificially cooled air be necessary, it was not considered essential to provide mechanical refrigeration in connection with this installation. Under more severe conditions, spray units and mechanical refrigeration or some other similar method could be provided and ample space is left on the housing for this feature if, later on, it should be desired.

The unit heaters have by-passes so that filtered air from the recirculation ducts can be by-passed around instead of through the units. These by-passes are controlled by dial-locked dampers which permit a very definite control of the temperature of the air forced to the plenum chamber and the dampers are regulated to force a comparatively large amount of *warm* humidified air rather than a smaller quantity of *hot* air.

For the five rooms equipped for auxiliary electric heat, well-insulated boxes or ovens with electric heater units of the strip type were installed at the foot of the risers in each warm-air duct. These heaters have capacities of 2, 2½ or 3 kw. per riser, and in the dining room two risers are so equipped. The push-button controls have illuminating lamps to show on and off operation and control the heater elements through magnetic switches. The response in heat production from these units is almost instantaneous. No forced draft is necessary to produce proper circulation due to the fact that the heaters are at the foot of the vertical risers.

An off-peak electric storage heater with an everdur tank having a capacity of 160 gal. of water per 24-hour period serves for receiving and storing the hot water for domestic supply. During the heating season—September 15 to June 15—a steam hot water generator (which is cheaper to operate than the electric) supplies hot water to this tank at a temperature high enough to keep the thermostatically-controlled electric units from operating. A waste heat economizer, through which is passed all steam condensate before it goes to the meter, preheats the domestic supply of hot water before it enters either the steam hot water generator or the electric storage tank.

Approximately 1600 sq. ft. of hot water radiation was installed in the house to take care of rooms that could not conveniently be reached with the warm-air ducts and to augment the warm-air system in other rooms which were found to be less than comfortably heated by the warm air alone. The owner desired to retain this hot water heat rather than have it changed over to direct steam radiators, so that two steam-hot water generators were installed to provide the hot water for the radiators. Direct steam radiation was installed in the laundry, drying room and kitchen, which had previously been kept warm by the laundry stoves and heavy duty coal ranges, all of which were dispensed with when the system was changed over to district steam.

A new field is opened for heating contractors as broad and appealing to the public as electric refrigeration, and contractors are urged to study and aggressively canvass for air conditioning in the home rather than restrict themselves to bidding only on such radiation jobs as may be brought into them by their customers. This broader field is unlimited and the public is in a receptive attitude. Most always it is easier to sell a complete well-planned job than a partial or makeshift installation. Close cooperation with the electric and gas company engineers is suggested, for they are constantly securing new prospects to turn over to the contractor and can help the contractor in his arguments and thus bring about more quickly a broad public acceptance of the advantages of this new class of business.

EDITORIALS

Pipe Welding Progresses

PIPE welding has reached a point where it is no longer an experiment, but is an accepted method of joining. Difficulties resulting from ill-trained mechanics and from failure to follow proved methods of procedure are still present to some extent, but even these are in a state where troubles are distinctly due to failure to use known information and not to lack of the information itself. In some localities labor difficulties are still the critical factor in holding back its wider use.

For use with heating piping, welding has made considerable headway and not only are there enough installations of long standing to prove its worth, but it is gaining in acceptance steadily in this field. More and more it is being used for joining even the smallest sizes of pipe. There is every indication that as the acceptance continues, pipe welding will find a place in smaller and smaller buildings. Probably it will not actually replace the other methods of fastening entirely, but it is even now in such a position that no one can continue to ignore either the present situation, or the plain signs of the direction in which the development of cheaper methods of welding is leading.

The Building Situation

NEARLY six months have passed since congress passed the two acts—the emergency relief and the home loan bank bills—which were expected to help the building industry. So far no concrete results of any value to the industry have resulted from either.

Examination of the wording of the relief act shows that since loans may be made only to corporations existing solely for the purpose of constructing low cost housing and existing under government supervision, applications could be granted only to projects in New York state. Before anything can be done in other states enabling acts must be passed. While movements are under way to get such laws in several states, they will necessarily be slow. The possibilities are great though, and we urge that every man in the industry give active support to these movements. Committees have been organized in Ohio, Illinois, Massachusetts, Indiana and Pennsylvania to promote the passage of suitable laws.

The loan banks also appear to be stalled. They have been in existence for three months, but there is no record of their having made a single loan. Already there is talk of modifying the law and it is questionable if any tangible results will appear for some time.

It looks very much as if the building industry is going to have to look elsewhere than to the results of these laws for stimulation of business for some time to come. About the only concrete results to be expected at once from government agencies lies in the continuation of public building programs. This building has accounted for a large part of the operations during 1932 and is likely to continue to do so for several months.

While results from government acts are thus slow, there have been other recent events which are encouraging. Material prices have stopped falling and labor rates have been reduced to a point where buildings can now be built which reflect present-day ideas of costs. These facts, together with signs of increased activity, should more than counterbalance the unfavorable reaction to the slowness with which the anticipated results of the relief and loan acts are being brought about. On the whole, we are in a more favorable technical position to take advantage of an increase in activity than at any time in recent months. The machinery is slowly getting set and adjusted, and will begin to grind with any loosening of the piled-up potential demand for good buildings.

Water—A Refrigerant

NOWADAYS we are used to learning that "revolutionary" discoveries have been made and that "new principles" are used in many new devices. In fact these words are so often used that most of us are probably wary about accepting at their face value announcements which assert that these things are true.

It is seldom, though, that any of us in the heating industry come quite as close to having these words really apply as is the case with the use of water as a refrigerant for air conditioning. It is true that its use is not exactly a "new principle" nor is it yet shown that it will prove "revolutionary," but it is relatively new and it does have possibilities of actually becoming revolutionary in time.

Just now the idea is in the stage where a great deal of study has been devoted to it, some equipments have appeared on the market, and a few installations are reported both in process and comfort work. Very few cost figures or installation and operating experiences are in existence, but these early installations should rapidly supply enough to permit a more intelligent opinion as to whether the equipments are actually to bring about a notable change in refrigerating practice in air conditioning.

The general idea of using water as a refrigerant and steam as the source of energy means that a boiler plant (or a steam supply) is a necessity; that this same plant, or supply, would serve to furnish energy for both winter and summer seasons; that the piping involved would be distinctly steam and water piping; and that both the heating engineer and contractor would be dealing with a substance with which they are both familiar. If steam refrigeration wins out it will mean that the whole field of air cooling will be even more logically a part of the work of the heating man than it is at present.

The movement is just nicely under way. Watch it, keep informed, and be prepared.

Your Everyday Problems

HEATING AND VENTILATING will be glad to answer your problems relating to installation and operation of heating and ventilating systems. Letters will be answered promptly, and in some cases published anonymously. If sketches are included they should be clearly drawn. Write The Editor, HEATING AND VENTILATING, 148 Lafayette Street, New York.

QUESTION 62. The owner of a recently-erected apartment house for which I was heating contractor has referred to me several complaints from the proprietor of a drug store occupying the northwest corner of the first floor, who states that he cannot keep his premises warm on cold days. When I computed the radiation I took accurate account of all heat losses through windows, doors, walls, etc., and added a 10% overage to allow for heat loss when the door is opened. Examination has shown that plenty of steam is delivered to the radiators. I have learned from the proprietor that an average of 160 customers visit his store every day, resulting in at least 320 openings and closings of the door. I am aware that addition of perhaps 20% more radiation would remedy the difficulty, but would like to know if there is a rule or formula for estimating the heat loss through periodically-opened doors. I have been unable to find any such.

F. E. M.

ANSWER. We are unaware of any formula or rule for estimating the heat loss through intermittently-opened doors. We would welcome reader information or opinion on this subject, and will publish satisfactory answers.

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QUESTION 63. What is the difference between the higher heating value and the lower heating value of fuels? In computing the efficiency of an oil-fired system, which heating value should be ascribed to the oil?

R. M. C.

ANSWER. When any fuel containing hydrogen as a constituent is burned, water will be found among the products of combustion, due to the combination of oxygen and hydrogen. At the completion of combustion, the products of combustion are at high temperature, and the water is present in the form of steam. Each pound of steam gives up 970.4 B.t.u. upon condensing to liquid water at atmospheric pressure, which takes place at 212°. If this condensation is allowed to occur so that this latent heat of steam can be recovered and usefully applied, the higher heating value of the fuel obtains. Conversely, if the products of combustion are discharged from the apparatus at a high temperature before the steam has been condensed, the lower heating value is realized from the fuel.

Accepted engineering practice specifies the use of the higher heating value for all fuels for boilers. The exact amount of loss is dependent upon the temperature to which the products of combustion are cooled, and can be computed with reasonable accuracy, but the loss per pound of fuel is generally assumed to be equal to

$$L = 970.4 \times 9 \times H$$

in which H is the per cent of hydrogen in the fuel by weight, expressed as a decimal.

●

QUESTION 64. How much allowance must be made for expansion and contraction in a 6-in. steel main carried for a distance of 165 ft. underground at a depth averaging about 4 ft.? It is proposed to carry steam at 15-lb. gauge in the pipe during the daytime, and no steam at night.

W. S. W.

ANSWER. Steam at 15-lb. gauge has a temperature of approximately 250°. We can assume that under extreme conditions the temperature of the pipe will fall to the freezing temperature, 32°. The coefficient of linear expansion for steel is 0.0000067 per degree temperature change. In this case, the temperature change will be 250 — 32 = 218°. Therefore, the increment in the length of the pipe will be:

$$d = 218 \times 165 \times 0.0000067 = 0.241 \text{ ft., or } 2.9 \text{ in.}$$

This amount of expansion can conveniently be taken care of by any of a number of expansion joints on the market.

●

QUESTION 65. We are contemplating installing an indirect water heating coil in connection with the oil-fired hot water heating boiler in a three-family dwelling. The boiler is adequate for its present purpose, maintaining comfortable conditions in all of the apartments in even extreme weather. We would like to know if the addition of the water heating load will materially reduce the heating capacity of the boiler.

E. M. R.

ANSWER. Common apartment house practice calls for 10 gal. of hot water per hour for each apartment with one bath. Assuming this to apply in the case in hand, it is reasonable to assume an hourly consumption of 30 gal. of hot water. To heat 1 gal. of water 120° requires 1000 B.t.u., or 30,000 B.t.u. additional output will be required of your heating equipment. This is equivalent to 200 sq. ft. of additional hot water radiation—about the amount of heat required to warm one large room of average exposure. The present boiler will therefore be able to assume the additional load, since it is evidently larger than is required to carry the present heating load.

Abstracts . . .

Reviews and Summaries of . . . . Current Papers, Books and Pamphlets

Handbook of Industrial Temperature and Humidity Measurement and Control

By M. F. Behar

Published by Instruments Publishing Co., Pittsburgh; cloth bound; 320 amply-illustrated pages; price $4; 6in. x 9¼ in.

It is seldom that we find a book which we can so wholeheartedly recommend to our readers as this one, which not only covers a subject so little written about, but which contains so much information and so much evidence of careful preparation that we wonder how it can be offered at so small a price. It is true that the field covered is limited to industrial instruments, but the discussions of temperature and humidity and the descriptions of the instruments available for their measurement are so closely akin to those used for our heating and ventilating applications that this limitation does not make the book any less valuable to us. Our readers will find some portions far removed from their ordinary requirements, but the remaining chapters are themselves well worth the price asked. There is no point in outlining its contents or in analyzing it as to style or viewpoint. The book must be read to be appreciated, and should be in the hands of everyone who has occasion to use or recommend temperature or humidity instruments.

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The Measurement, in Relation to Human Comfort, of the Radiation Produced by Various Heating Systems

By H. M. Vernon

A paper presented before the Institution of Heating and Ventilating Engineers (Great Britain) October, 1932; approximately 12,000 words with many tables, graphs and photographs.

Another of the series of papers presented by Doctor Vernon describing his work on the effects of radiant heat as used in building heating work. In this he tells of a thermometer consisting of a 6-in. copper globe painted matt black and having a thermometer with its bulb at the center. This thermometer reads the temperature resulting from the combined effects of the radiation and convection received from the surroundings. If a second thermometer is used to read the air temperature surrounding the globe, the difference between the readings of the two thermometers is what the author calls the "effectual radiation temperature." Using this instrument in rooms heated by various radiant means he was able to collect data to find the air temperature and the effectual radiation temperature when comfortable conditions were being maintained. Among the heating methods which he touches on are radiant gas heaters, high temperature panels, low temperature ceiling panels, a plenum air system, an underfloor system, and hot water radiators. He also collected some data when comfortable conditions were obtained when he sat in direct sun heat. In addition, he observed the effects of a number of special conditions such as turning panel heating on and off, and opening and closing windows. Doctor Vernon sums up his findings as follows:

"When the atmospheric conditions in rooms warmed by a gas fire, a stove, or ceiling panels were such as to create a sensation of comfortable warmth, the globe thermometer temperature was always about 62°, although the air temperature varied from 49.3° to 61.7°, and the effectual radiation temperature from 12.8° to 0.4°.

"At a distance of 6 ft. from a gas fire and a stove, the effectual radiation temperature was 12° and 4.4°, respectively, and at the same distance from a hot water radiator it was 1.2°. In rooms warmed by high-temperature overhead heaters it was 4.3°, while in rooms with ceiling panels heated to 98° it was 1.5°. An underfloor heating system gave a temperature of 1.2°.

"The effectual radiation temperature is greatly influenced by the air velocity. An air current of 270 f.p.m. lowered the effectual radiation temperature induced by a gas fire to less than half, and lowered that induced by a stove to a third, of the respective radiation temperatures observed in still air.

"The effectual radiation temperature varies greatly with the opening of windows and the turning on and off of the heating system. In a ceiling-panel room it rose from 1.8° to 5.0° when the windows were opened for 1¼ hr., owing to the lag between the wall temperature and the lowered air temperature. Another room showed a *negative* radiation temperature of 4° one hour after the warm plenum air supply was turned on, owing to the lag in the warming up of the walls.

"A negative radiation temperature of 1.4° to 0.4° was observed at a distance of 2 ft. from a window, when the air temperature outside was 21° to 5° lower than that in the room.

"The effectual radiation temperature induced by the sun on a summer's day out of doors, as indicated by a cloth-covered globe, is about 30°, but a globe covered with white linen showed a radiation temperature of only 10°. When two subjects, clad in dark clothes or in white linen, sat in the sunshine at an air temperature of 53° or 63°, they experienced comfort sensations corresponding to the temperature effects indicated by the globe thermometers."

While these findings are pertinent to a study of heating methods where both radiant and convected heat are used, the studies are not yet complete and the author points this out when he says:

"It is generally agreed that a certain amount of radiant heating is more pleasant and exhilarating than pure convection heating, but there is not sufficient evi-

dence to indicate what is the most desirable amount. Almost everyone would admit that rooms heated only by gas fires suffer from too much radiation. On the other hand, we have seen that ceiling panels at a temperature of about 100° warm rooms adequately, but the effectual radiation temperature of less than 2° which they induce may be too low. The panels are usually distributed so as to warm the whole room almost equally, and if their temperature were raised so as to induce a radiation temperature of 3° or 4° the air would be too warm for comfort. It would, therefore, be necessary to diminish the size of the panels and to localize them to a greater extent than at present. The heating of various regions in the room would then be unequal, though not so unequal as that induced by a gas fire. It is evident that the most advantageous method of distributing the heating units can be ascertained only by testing numerous combinations of panel distributions and panel temperatures."

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Induction Heating of Greenhouses

By G. N. Hawley and M. R. Armstrong

From "Electrical World," August, 27, 1932; approximately 600 words; 1 illustration, 2 charts.

Report of tests made by the Southern California Edison Company to determine heating effect of single alternating current conductors enclosed in steel conduit. Greenhouse heating element must be waterproof and should operate at a low temperature gradient and give wide distribution to minimize heat loss through glass due to rapid air circulation.

A chart shows results of tests made with No. 12 asbestos-covered copper wire encased in ½ in. steel conduit. Power factor obtained in test proved to be around 90%, although it had been expected to be lower.

In test made in actual greenhouse installation, round wire, asbestos-covered, was encased in steel conduit tubing. One circuit, consisting of 158 ft. of wire and conduit was connected to a 220-volt supply and found to take 5.9 kw., an energy dissipation of 37.5 watts per lin. ft. Temperature of surface of conduit was 240° and surrounding air temperature was 75°. Expense was only about half as much as equivalent steam or hot water.

About 25 to 40 watts per lin. ft. of wire and conduit are recommended for greenhouse work. About 0.2 watt per degree temperature difference per square foot of glass is required. On still nights, the figure dropped to 0.15 watt, and on windy nights rose to 0.3 watt.

●

Air Conditioning for Comfort

By S. R. Lewis

Cloth bound book; published by Engineering Publications, Inc., Chicago; price $2; 244 pages; 5¼ in. x 8½ in.

In this first book which has appeared dealing at all comprehensively with the subject, the author has produced a work in his usual direct style. Its plan is indeed simple, as he states in his preface. He first takes up the principles and then shows their application by the use of simple examples. A considerable part of the book is devoted to the necessary data for use in calculating, and a working size psychrometric chart is included. In the chapter on heat transmission much of the material is reprinted direct, but in the chapter in which calculations for obtaining sun effect are presented the author illustrates calculations not commonly found in other books. An excellent feature is an example which is worked out in some detail illustrating the method of computing sizes of equipment for a dwelling house which is to be both heated and cooled. Such a book as this has been needed and should meet with a cordial reception.

●

Thermocouple Psychrometer Requires No Artificial Air Motion

Abstracted from "Ein Psychrometer onhe kuenstliche Belueftung," by H. Wald; Zeit. f. d. Gesamte Kalte Industrie; No. 6, June, 1932; approximately 4500 words.

ABSTRACTED BY A. A. BERESTNEFF

The usual psychrometer has either a fan for creating air circulation or must be rotated rapidly to obtain quick heat transfer from the surrounding air to the wet bulb thermometer. The writer explains another way to stimulate this heat transfer; namely, by using a thermocouple with very small diameter wire.

For any psychrometer, the total heat obtained for evaporation Q_t is equal to Q_a, the heat transmitted from the air, plus Q_e, which includes the heat transmitted through the wires of the thermocouple, that which is conducted through the stem of the mercury thermometer, the heat of resistance in the wires of the thermocouple, the radiant heat from the surroundings, etc. The portion of the heat contained in Q_e is responsible for errors in psychrometer readings.

To minimize these errors the writer recommends: (1) use of a compensating winding to eliminate the effect of the resistance heat; and (2) shielding the thermocouple to prevent radiation (necessary if the difference between the room temperature and wet bulb temperature exceeds 18°).

There are two different ways to decrease the main source of error—the heat transmitted through the wires. One method consists in making the wires of such a material and of such dimensions as to retard the flow of heat. Experiments made with iron-constantan thermocouples and copper-constantan thermocouples showed that for the same dimensions of wires, etc., the wet bulb depression, as measured by the iron-constantan couple, is always about 5% greater than if measured by the copper-constantan couple because of the smaller heat conductivity of iron as compared with copper. Decreasing the wire diameter also has quite an influence on the measured wet bulb depression.

The second way, which makes it possible to eliminate entirely the heat transferred by the wires and stems, is to elongate the wet covering or wicking up to about 1.2 in. on both sides of the soldered point. This causes the transmitted heat to be consumed for evaporation so far from the soldered point that it has no practical influence on the readings. An extension of the covering from 0.2 in. to 2.4 in. increased the wet bulb depression 20%.

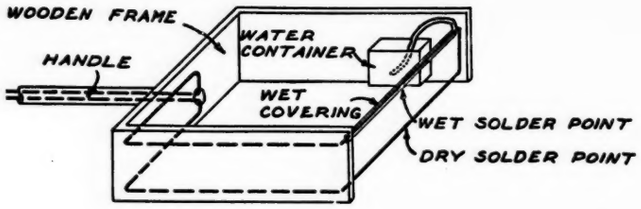


Fig. 1

As mentioned, the process of evaporation and, consequently, a more exact measurement of wet bulb temperature, can be stimulated by decreasing the diameter of the wire and covering. Experiments were made with wire diameters from 0.04 to 0.002 in. (total diameter of the covering at the wet soldered point is about 0.02 in.). The results show that, beginning with 0.002 in., the measured value of the wet bulb depression is very near to the theoretical ideal value. Using 0.004-0.002 in. diameter wire, the measured value of the wet bulb depression reaches 90% of the theoretical. This is important if we remember that for a usual mercury psychrometer the artificial air motion increases the percentage from 65% to 95%, the difference between both methods thus being only 5%.

The proposed form of psychrometer is shown in Fig. 1. By means of a special system of wiring the instrument can be switched so as to measure the dry bulb temperature.

The special table usually attached to the "aspiration psychrometer" for direct determination of relative humidity can also be used with the thermocouple. For this application it is necessary to compare but once the results of measuring the wet bulb depression, as obtained by Assmann's psychrometer and by the new thermocouple, after which comparison, the values of relative humidity can be read directly from the same table.

●

Arc Welded Cores for Unit Heaters and Coolers

By Carl J. Winkler and George L. Pyritz

From "A Suggested Application of Arc Welding to Unit Heater Design," a paper submitted for the second Lincoln Arc Welding Prize Competition, sponsored by The Lincoln Electric Co., Cleveland.

Heat exchange sections built up of steel stampings electric arc-welded together suggest several interesting advantages, especially when used in connection with direct or indirect refrigeration in space cooling.

Such a heat exchange surface could be joined to a suitable header of the same material, and all joints could be made without the use of gaskets or packing of any kind. This would eliminate the problem of corrosion always present where two or more metals having different electro-chemical characteristics are in contact with an electrolytic solution.

The design of the elements of the heat exchange section could be such as to prevent localized stresses and permit repeated elongations and contractions without straining any part. Stainless steel is mentioned as probably the most satisfactory for the purpose. Nickel, monel, sheet steel, and others may also be used, the only requirement being that the material can be welded and will withstand simple drawing operations. This construction will be possessed of sufficient strength to be used with the required internal pressures.

In conclusion, a comparison of costs is drawn between iron pipe cooling coils and welded steel unit coolers of equal capacity, in which the welded sections show up to advantage.

●

An Optical Method for Measuring Temperature Distribution and Convective Heat Transfer

By R. B. Kennard

Research Paper No. 452 of the Bureau of Standards; illustrated; obtainable through Superintendent of Documents; price 5 cents; 24 pages; 6 in. x 9 in.

Description of the methods used in developing a temperature distribution measurement which would avoid errors which occur when material thermometers are used in examining certain phases of the film theory of heat transfer between a solid and a fluid.

Author used a method of measuring the temperature of an air film near a hot surface by an interferometer. He photographed the interference fringes near a hot vertical plate and near horizontal heated cylinders and determined the temperature and heat transfer. The temperature distribution found by this method did not correspond to that called for by the film theory.

●

Refrigeration

By Moyer and Fittz

Second edition; well illustrated; published by McGraw-Hill Book Co., Inc., New York; cloth bound; price $5; 538 pages; 6 in. x 9 in.

Written in a style to appeal to both engineering students and practicing engineers, and thorough in the theory, operation, and testing of refrigeration plants, this second edition is greatly expanded. Much of the new material deals with recent designs of domestic refrigerators. The material on these plants is probably the most complete which appears in any existing book. Air conditioning uses of refrigeration come in for due attention, with a series of examples worked out to illustrate calculation methods as well as a brief statement of principles.

The table of contents follows:

1. Refrigeration Methods
2. Systems of Refrigeration
3. Properties of Refrigerants
4. Compressors for Refrigerating Plants
5. Household Mechanical Refrigeration
6. Operation of Refrigeration Systems
7. Thermodynamics of Refrigerating Systems
8. Refrigeration Economics and Plant Testing
9. Ice Making
10. Insulation and Cold-Storage Construction
11. Small Commercial Refrigerators
12. Air Circulation and Ventilation in Cold Storage
13. Cold Storage of Foods
14. Quick Freezing
15. Production of Solid Carbon Dioxide
16. Air Conditioning

Problems in Refrigeration.
Tables and Charts.

News of the Month

Harbula Reviews Comfort Cooling Before A.S.P.R.E.

A paper, "Comfort Cooling," was presented by M. G. Harbula, consulting engineer, Glen Ellyn, Ill., before the 23rd annual convention of the National Association of Practical Refrigerating Engineers, Hotel Sherman, Chicago, November 1-4.

Mr. Harbula's treatment of the subject covered both ice cooling equipment and installations employing mechanical refrigeration, and included a discussion of cost of installation and operation. Attention was directed to the fallacy of installing complete air conditioning equipment in smaller restaurants and stores in which cooling is required for only a few hours each year. Such an installation would incur fixed charges and operating costs that could not be justified by the resulting increased revenue to the business.

Following this, a paper entitled "Unit Coolers," by George B. Bright, consulting engineer, Detroit, was read by an associate, R. C. Doremus. Slides illustrating the construction and application of unit coolers accompanied the discourse, and the various problems of installation and operation were discussed.

Dr. Winslow Criticizes Ventilating Code

Dr. Leonard Greenburg, of Yale University, Albert J. Nesbitt, of John J. Nesbitt, Inc., and W. H. Driscoll, vice president of Thompson-Starrett Co., Inc., addressed the New York chapter of the A.S.H.V.E. at the monthly meeting held November 21.

Dr. Greenburg, represented Dr. C.-E. A. Winslow, also of Yale, who was unable to be present. Dr. Greenburg read a brief paper by Dr. Winslow, in which he commented on the society's ventilation code. Two criticisms were made, one being that there was no physiological basis for the requirement of 30% relative humidity, and that such a rule would make it necessary to have air conditioning equipment for practically every ventilating job. The other criticism related to the measuring of the effect of air distribution in the room, the code calling for a difference in CO_2 readings not to exceed one part in 10,000. Dr. Winslow's opinion was that this requirement is too severe, and that with portable apparatus it would be difficult to measure the CO_2 content closer than two or three parts per 10,000.

Mr. Nesbitt presented an interesting analysis of tests made in a Philadelphia school with a unit ventilator. The analysis showed that on an average winter day with an outside temperature between thirty and forty degrees, and with the sun shining, no heat was needed in the room, but rather the air had to be introduced into the room at lower than room temperature to carry off the heat from the children and that from the sun. Since it was found that for the installation under consideration that the air could not be brought into the room more than 10° below room temperature, it was necessary to introduce between 25 and 30 c.f.m. per pupil.

A brief history of ventilation and of the ventilation code was given by Mr. Driscoll, who was chairman of the committee which framed the code. The speaker defended the engineering profession in the matter of ventilation, saying that the medical profession, to which engineers looked for guidance in setting up standards of ventilation, had failed to agree as to what constitutes good ventilation. He further stated that the code committee would not yield to individual opinions from medical men but would be glad to consider changes sponsored by the medical profession as a whole.

A. S. A. to Continue Work on Safety Code for Exhaust Systems

Development of plans for renewing activity to bring about the completion of the safety code for exhaust systems is being undertaken by the Safety Code Correlating Committee of the American Standards Association. Relinquishment of sponsorship of the project by the American Society of Heating and Ventilating Engineers has necessitated reassignment.

A. S. M. E. to Hold Meeting on Boiler Settings

Setting heights for small boilers will be discussed with representatives of interested groups by the Pure Air Committee of the American Society of Mechanical Engineers, at a meeting called for December 9 at the Engineering Societies Building, New York. The Boiler Setting Sub-Committee of the Pure Air Committee is not in accord with some of the recommenda-

Testing controls in a corner of The Fulton Sylphon Company's physical laboratory, Knoxville, Tenn.

tions of the Midwest Stoker Association, and an attempt will be made at this time to reach an agreement.

T. A. Marsh, president of The Modern Coal Burner Company, and Capt. W. H. Gray, chief engineer of the Iron Fireman Manufacturing Company, will represent the Midwest Stoker Association and the manufacturers of small stokers. H. A. Glover, chairman of the Committee of Ten, has been designated as official observer for his organization, and J. R. Evans, assistant to the president of the Island Creek Coal Company, has been appointed to represent the National Coal Association.

A.S.R.E. to Discuss Air Conditioning

"Air Conditioning" is the scheduled topic for the opening session of the 28th annual meeting of the American Society of Refrigerating Engineers, to be held at the New Yorker Hotel, New York, December 7-9. Under this head J. A. Goff, assistant professor, mechanical engineering department, University of Illinois, will deliver an address, "Air Conditioning Theory: Classroom Methods of Presentation," described as a technical discussion of the fundamentals of the subject.

George B. Bright, consulting engineer, Detroit, will present a paper on "Comfort Cooling with Ice in 1932," and John Everetts, Jr., New York, will discuss "Water as a Refrigerant" at the same session.

Baer Elected Vice-President of Carbondale Machine

A. H. Baer, who recently resigned as sales manager of the ice and refrigerating department of the Frick Co., Inc., Waynesboro, Pa., has been elected vice-president of the Carbondale Machine Co., Carbondale, Pa. He assumed his new duties November 1.

Taylor New Chicago Manager for A. M. Byers

W. A. Taylor, formerly assistant manager, has been appointed division manager in charge of the Chicago office of the A. M. Byers Co., Pittsburgh. Mr. Taylor replaced M. G. Henderson, who resigned.

Refrigerating Engineers Devote Meeting to Air Conditioning

About one hundred members and guests of the New York section, American Society of Refrigerating Engineers, attended a meeting in the auditorium of the Electrical Institute, November 10, in which air conditioning and comfort cooling were discussed. R. W. Waterfill spoke on practical applications of the steam ejector water cooler, featuring the important part this apparatus has played in the adaptation of air conditioning to railroad cars. J. I. Lyle took a prominent part in the discussion which followed Mr. Waterfill's discourse, in which the problem of pressure drop in the steam line of a train was brought up. This drop is due, it was pointed out, to frictional resistance in the 1½-in. pipe used in practice, and the application of larger pipe has been found to improve the condition.

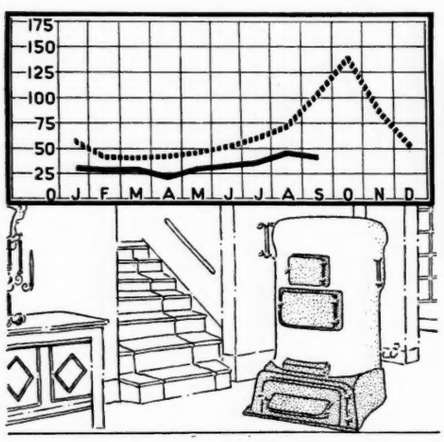
J. F. Munder, Jr., described the development of the unit form of air conditioner, and brought out the fact that this type of apparatus has made it possible for the home owner, the small store proprietor, and other operators of small commercial enterprises to enjoy the benefits had by the owners of large central air conditioning systems.

Ontario Chapter Hears Discussion on Controls

An illustrated lecture, "Temperature Control Systems," was delivered by G. Playfair before the Ontario Chapter, A.S.H.V.E., at its regular meeting held in Toronto, November 7.

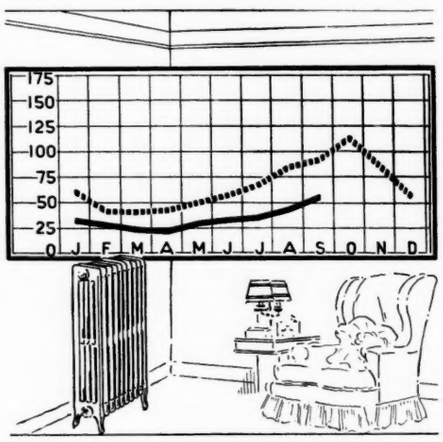
A. S. H. V. E. Reduces Dues

Dues for members of the A.S.H.V.E. were substantially reduced by the Council at a meeting held at the Building Trades Employers Club, New York, November 21. The annual dues for members and associate members were reduced from $25 per



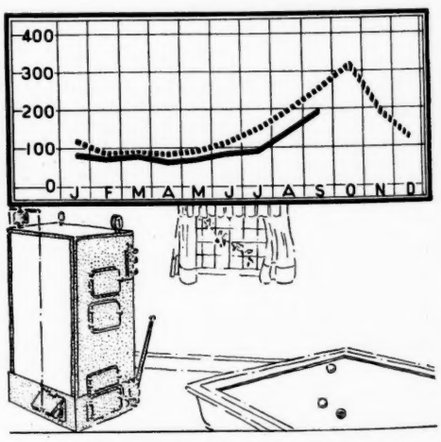
CAST-IRON ROUND BOILERS

September showed a decrease in round boiler shipments (thousands of pounds) of 6.3%, as compared with August. Normally, this month shows a seasonal increase of 17.6%. This is only the second time since 1925 that September showed such a drop.



CAST-IRON RADIATORS

A more than seasonal increase in shipments of cast-iron radiators (in square feet) was shown in September, as compared with August. The normal increase for this month over August is 4.6%, while this year the rise amounted to 22.9%.



CAST-IRON SQUARE BOILERS

A sharp jump in square boiler shipments (in thousands of pounds) took place in September. There is a normal seasonal increase of 18.8% from August to September, but this year the increase amounted to 40.3%.

year to $18. The new rates will apply to the year 1933.

Action of the Council followed the passing of a resolution by the society to amend the constitution to read that the dues are as set by the Council.

Harvard to Study Fans and Blowers

Establishment of a fan testing laboratory at Harvard University, Cambridge, Mass., has been announced by Prof. H. E. Clifford, dean of the Harvard Engineering School. This project has been undertaken because of the increasing importance of mechanical air movement and temperature control in modern building construction.

Preliminary studies have revealed that failure of fans to deliver rated capacities in practice is due to improper installation. Inlet boxes and ducts commonly used with commercial fans may reduce the capacities of the fans by as much as 50%, and according to the findings, simple adjustments can result in large savings. Further studies are to investigate the effect of air pulsations on fan performance, and a new standard test code for fans taking this factor into account has been proposed and submitted to the interested engineering societies. Axial flow fans are also being studied extensively.

Western Pennsylvania Better-Heating Group Hears Grimes and Huntress

Oliver J. Grimes, managing director of the Committee of Ten, Coal and Heating Industries, and Carroll B. Huntress, executive secretary of the National Coal Association, were guest speakers at the dinner meeting which started the season's activities of the Better Heating Association of Western Pennsylvania, Pittsburgh, November 9. The meeting was attended by coal and coke producers, retailers, and coal equipment men within the Pittsburgh area.

Fleisher Talks on Steam Ejector Refrigeration

"Cooling by Means of a Steam Ejector System" was the title of a paper presented by Walter L. Fleisher, consulting engineer, New York, before the Chicago chapter, A.S.H.V.E., at its regular meeting, November 14, in the Sherman Hotel, Chicago. Mr. Fleisher predicted that this type of system will find wide application in the residential and small building field as a result of its low initial cost, low operating cost, and flexibility in use.

A discussion, "The Architect's Viewpoint on Ventilation," by W. I. Hooper resulted in the passing of a resolution by the chapter providing that the members of the Better Relations Committee meet with a committee from the Chicago chapter of the A.I.A. for the purpose of seeking a better ground of mutual understanding.

Fuel Oil Sales Dropped in 1931

Deliveries of light and heavy fuel oils for the heating of buildings declined from 43 million barrels in 1930 to 40 million barrels in 1931, a reduction of 6.7%, according to a report recently released by the United States Bureau of Mines. This constitutes the first decline in volume of oil sold for this purpose since it came into wide use as a building heating fuel, although at least some of the decline is due to the mild winter of 1930-31.

The accompanying figures show the amount of oil delivered for both domestic and commercial heating purposes during the past five years. It will be noted that a sharper decline was recorded in the sale of oil for commercial heating than in that for domestic heating.

DELIVERIES OF OIL FOR BUILDING HEATING
(In millions of barrels)

Year	Domestic Heating	Commercial Heating
1927	11.7	15.7
1928	14.3	16.4
1929	17.6	17.7
1930	25.8	17.5
1931	24.7	15.7

Harding and Davidson Address A.S.M.E.

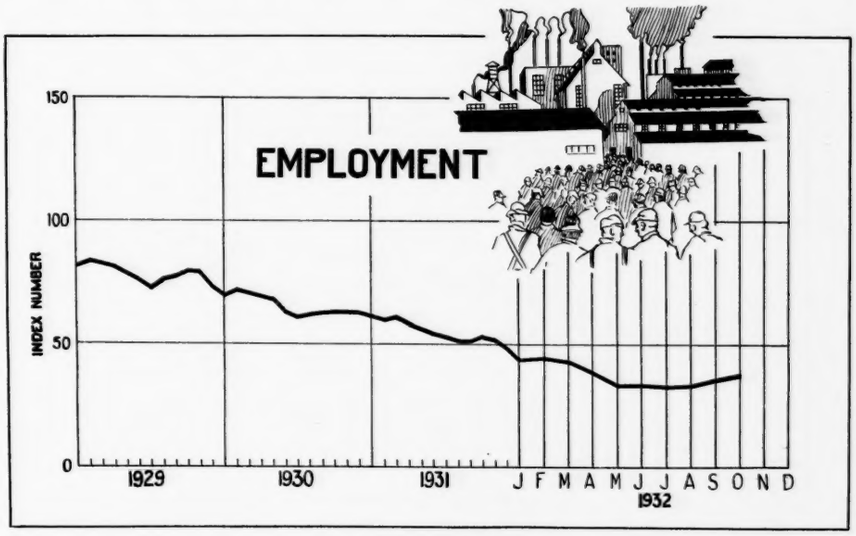
L. A. Harding, president of the L. A. Harding Construction Corporation, addressed the Buffalo section of the A.S.M.E., November 15, on the subject "Utilization of the Sun's Energy." P. L. Davidson, of the Carrier Engineering Corporation, spoke before the Philadelphia section of the same society, November 22, on "Developments in Air Conditioning."

National Tube Appoints McKee

National Tube Co., Pittsburgh, has appointed William J. McKee manager of sales of its New York district. Mr. McKee was formerly assistant manager of sales.

Oil Burner Patent Infringements Charged

Motor Wheel Corp., Lansing, Mich., and Ben Valjean, holder of



EMPLOYMENT
in the steamfittings manufacturing plants continued to rise during October. The chart shows a rise in the index number (1926 = 100) from 35.5 in September to 37.3 in October. The low was July, with an index number of 32.5.

basic oil burner patents, are co-plaintiffs in an action instituted against The Perfection Stove Co., Cleveland, and Sears Roebuck & Co., Chicago, in the United States District Court at Chicago. It is complained that the line of oil burners using the carbureting principle of premixing the fuel vapor and air to form a combustible gas as manufactured and sold by the defendants, infringe the Valjean patents.

Gilbert & Barker Appoints New Executives

Stanley C. Hope, P. H. Bills, and J. G. O'Conor were elected president and general manager, vice-president and treasurer, and executive assistant to the president, respectively, of the Gilbert & Barker Manufacturing Co., Springfield, Mass., November 1.

Warm-Air Furnaces Built by 44 Companies in Canada

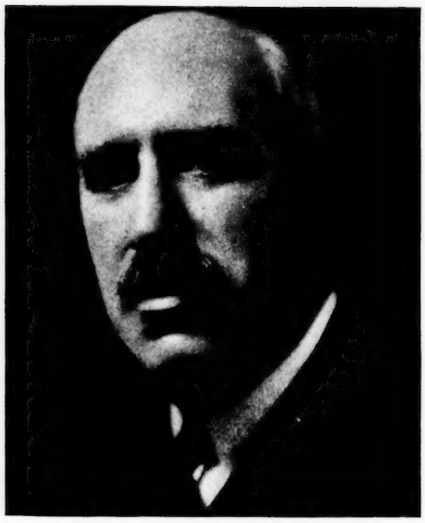
Canadian production of warm-air furnaces during 1931 amounted to 17,305 units, with a total value at places of manufacture of $1,276,437, according to a report from Lynn W. Meekins, of the U. S. Dept. of Commerce, Ottawa.

This industry at present is composed of 44 factories located in six provinces of Canada, it was stated.

The 1931 output was the lowest in number of units made for any year since 1929, when 34,594 furnaces were manufactured, and the lowest in selling value for any year since 1928, when production was valued at $2,580,292. Despite this showing, the unit value of the 1931 output was $73.76, as compared with $62.57 for 1930.

Finney to Assist President of N. A. M. P.

Nathaniel S. Finney, of the Plumbing and Heating Industries Bureau, has been appointed assistant to Edward B. Kleine, president of the National Association of Master Plumbers. In this capacity he will aid the committee arranging the 51st annual convention and exposition to be held in New Orleans, La., June 19-22, 1933.



W. S. Shipley

Shipley Elected President of R. M. A.

W. S. Shipley, president of the York Ice Machinery Corporation, was elected president of the Refrigerating Machinery Association at the 19th annual meeting of the association, held in the Book-Cadillac Hotel, Detroit, October 20-22.

Fuel Gas from Hard Coal May Cut Cost

Production from anthracite of fuel gas equivalent to city gas which can be sold for as little as 20 cents per 1000 cu. ft., is predicted in an announcement by the Anthracite Institute, stating that it has ready for commercial use a machine for generating gas from hard coal. This estimated cost includes power, water, and maintenance of the equipment, as well as the cost of the coal burned. Many utility companies are now charging 90 cents per 1000 cu. ft. for gas for domestic use, with the price dropping to as low as 45 cents for large industrial and commercial users.

Anthracite gas is said to be very flexible in its application, and adapts itself to a wide range of heat requirements, permitting standardization of an entire plant on one fuel. A survey of the industrial gas field has indicated a potential market for 18,000,000 tons of hard coal each year for this purpose.

COMING EVENTS

DECEMBER 5-9, 1932. Annual Meeting of the American Society of Mechanical Engineers. Headquarters at 33 West 39th St., New York.

DECEMBER 5-10, 1932. Tenth National Exposition of Power and Mechanical Engineering, to be held at the Grand Central Palace, New York.

DECEMBER 7-8, 1932. Meeting of the National Warm Air Heating Association, to be held in Urbana, Ill. Headquarters at the Urbana-Lincoln Hotel.

DECEMBER 7-9, 1932. Twenty-Eighth Annual Meeting of the American Society of Refrigerating Engineers. Headquarters at the New Yorker Hotel, New York.

JANUARY 23-25, 1933. Thirty-Ninth Annual Meeting of the American Society of Heating and Ventilating Engineers. Headquarters at the Hotel Gibson, Cincinnati, Ohio.

JUNE 12-17, 1933. Tenth Annual Convention of the American Oil Burner Association, to be held in Chicago. Headquarters at the Hotel Stevens.

JUNE 19-22, 1933. Fifty-First Annual Convention and Exposition of the National Association of Master Plumbers, to be held in New Orleans, La.

Thermal Units to Manufacture Soverhill Heaters

Thermal Units Manufacturing Co., Chicago, has secured exclusive rights for the manufacture and sale of Soverhill electric grid heaters, formerly made by the Soverhill Engineering Company.

Automobile Industry Turns to Closed Car Ventilation

In an analysis of causes of accidents due to faulty construction, design, or maintenance, prepared by Maxwell Halsey, traffic engineer for the National Bureau of Casualty and Surety Underwriters, it is pointed out that poor air conditions within a closed car not only make driving uncomfortable but in addition tend to dull the senses, increasing the accident liability. The front floor boards are considered to be the most leaky part of the car body, and it is at this point through which gases from the engine and those drawn up from other cars are blown directly in to the passengers. Opening of the windshield is shown to be hazardous, due to the considerable draft resulting, and to the danger of injury to eyes from small stones and insects that may be blown into the car. It is suggested that ventilation could be satisfactorily accomplished by discharging air from the car, and replacing it by air drawn in through the numerous small gaps around doors, windows, and flooring.

Almost simultaneously with the publication of the above analysis,

General Motors Corporation has announced the Fisher ventilation system for its enclosed cars, claimed to incorporate numerous innovations and advantages.

Central Supply Association Reappoints McCollum Secretary

Appointment of W. E. McCollum to the office of secretary-treasurer of the Central Supply Association has been announced by W. J. Spillane, president of the association. The post became vacant upon the resignation of Robert Macfee. Mr. McCollum previously occupied the office, but had resigned January 1.

Five New Agents for McDermott Water Heaters

Appointment of the following agents has been announced by McDermott Water Heaters, Inc., New York: International Engineering and Supply Co., 102 North Broadway, St. Louis; Federal Steam Specialties Co., 120 East Main St., Oklahoma City, Okla.; J. N. Belanger Heating Co., 7611 Sixth Ave., N. E., Seattle, Wash.; J. M. Aikman, 702 Minnesota Building, St. Paul, Minn.; George D. Roberts, 128 Wellington St., Springfield, Mass.

New Engineering Society Formed

Formation of a society of professional engineers, the purpose of which is to raise the engineer in public estimation and secure for him recognition comparable to that accorded the members of other professions, was recently announced in New York. The organization is known as the National Association of Engineers, and its membership will include engineers of the electrical, chemical, civil, mechanical, and other classifications practicing throughout the United States.

R. M. Sanders, production engineer, 460 West 34th St., New York, is temporary chairman of the movement. In a formal statement, he indicated that the new organization does not conflict with the older national engineering bodies, but will endeavor to supplement their work from a human, rather than scientific angle.

Davis Engineering Has New St. Louis Representative

Davis Engineering Corp., New York, has appointed Frederick E. Bausch, 1614 Chemical Building, St. Louis, Mo., as its representative in that district.

NEW CATALOGS

Republic Steel Corp., Youngstown, Ohio, has issued a new price card on Toncan copper molybdenum iron pipe. The new card, No. 4, embodies a simplified method of computing prices.

Taylor Forge & Pipe Works, Box 485, Chicago, has issued a booklet treating in general the subject of welding, and discussing particularly the applications of seamless steel fittings manufactured by the company; 7 pages, 5½ in. x 8½ in.

The Carpenter Steel Co., Welded Alloy Tube Div., 100 Broadway, New York, has issued a bulletin on welded stainless steel tubing, describing the engineering characteristics of its products and giving working instructions.

The Lincoln Electric Co., Cleveland, has published a bulletin descriptive of the new Lincoln Shield-Arc welder.

Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, has issued Bulletin No. 300 describing the new line of Bailey fluid meters. Applications and installation methods are included in the text which is illustrated with photographs and diagrams. Standard size, 23 pages.

The American Brass Co., Waterbury, Conn., has issued a bulletin descriptive of Everdur metal, a high strength material for rustproof tanks. Contains properties and characteristics of Everdur, and photographs of a number of representative products. Eight pages, standard size.

Builders Iron Foundry, Providence, R. I., has issued Bulletin 261, devoted to Chronoflo wide range electric fluid meters; 12 pages.

American Radiator Co., 40 West 40 St., New York, has issued a catalog describing the Ideal magazine boiler. Performance data and ratings for both the No. 25 boiler and the new No. 15 boiler are included. The catalog is directed to homeowners, architects, builders, and heating contractors; 15 pages.

Inland Steel Co., First National Bank Building, Chicago, has published "Inland Sheet and Strip Steel Products," a 64-page booklet containing information valuable to buyers of steel sheets and strip. Includes trade practices, bundling tables, weights, standard tolerances, etc., for all products of the company.

Armstrong Machine Works, Three Rivers, Mich., has published a manual on steam trap engineering which includes descriptive matter on the inverted bucket traps manufactured by that company. It is intended as an aid in selecting the proper trap equipment to meet any specific requirement. Chapters on size determination, calculation of condensation rate, and installation and maintenance of traps are included. Standard size, 28 pages, illustrated.

Keystone-Underwood

Vatican Government Palace now is equipped with automatic heat, Quiet May oil burners having been installed recently

If Thou Canst Not Get a Whole Pig—Take Sausage

By Ab El Pilauf

When the money changers of Bagdad drew tightly on the purse strings of their capital, great was the outcry and tumult among the artificers and rabble.

The Caliph gave forth optimistic interviews, publicly, while privately he stacked his shekels in his sock.

At the bazaars in the market place, there was much whispering. "Couldst I secure a loan," said Muley-Haj, "I wouldst build a modern bazaar upon this eyesore. It wouldst provide much work for those in want. But—" he shrugged his shoulders despairingly.

"And I," said Rustem-Bey, "hath herds of customers who want my work, but alas, they hath no shekels with which to pay. Allah hath n'er sent us more dolorous times."

Their groans were silenced by the clatter of hoofs of the camel of Huz-El-Jak hurrying along the hard road. Muley-Haj arose and flagged him down. "Whither hasteneth thou, brother? Hast thou not heard the calamitous news? The economic readjustment groweth worse. Money changer after money changer hath folded up his tent and ducked. Those who wouldst buy our wares are bust, and woe reigns throughout the land."

"What thou sayest may be true," said Huz-El-Jak, "but I hath been too busy to notice these disasters. True, I hath seen no more large tents being built for the faithful. But the ones that are built hath need of repair, for they are wearing out. I hath kept my gangs busy on this work for many moons, and I hath also kept on the jump."

"But thy profit on this junk hath been but a pittance," said Wazir, derisively.

"True enough," grinned Huz-El-Jak, "but many pittances make much profit. It hath kept me on the jump from dawn till dusk."

"But the shekels?" queried Rustem-Bey. "How doth thou collect thy shekels from such as Hafid, the goatherd, who, all men know, is slow pay even in prosperous times?"

"Hafid and I are agreed upon payment which he maketh promptly each seventh day, for seven moons," said Huz-El-Jak, cheerfully, preparing to be on his way.

From the top of his camel he grinned down upon them. "And now, brothers, I must deprive you of the benefits of my society. I go in haste to fit up a more commodious studio for Mustpha-Buc, the soothsayer, who, since these delirious times hath descended upon us, hath a most ungodly rush of business from the faithful who seek to peer behind the veil of the future."

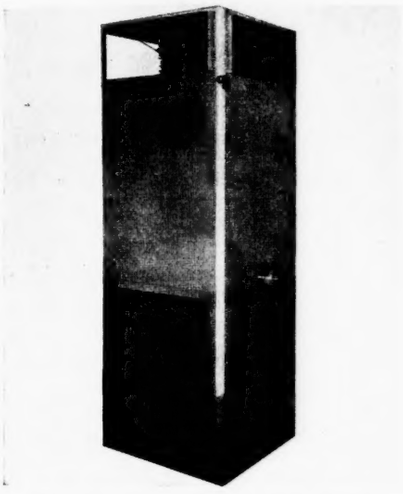
"And what sayest the soothsayer?" asked Muley-Haj, eagerly.

Huz-El-Jak cranked up his camel and prepared to goad it into going places. "He telleth them, one and all, that fame and fortune awaiteth them just around the corner. But," he added, with a wink, "he telleth me privately that until they unsquat themselves from their inactive tents, which are round and hath no corners, how canst they prove he sayest what is false?" And crying "Selam Aleikum," Huz-El-Jak was gone.

New Equipment

G. E. Announces Air Conditioner

For use in conjunction with its oil-fired boiler, General Electric Co., Schenectady, N. Y., has placed an air conditioning unit on the market.



General Electric air conditioner

The combination of the two results in a warm-air heating system and is also applicable to existing plants, in which case the combination supplants the old furnace and a new basement leader layout is connected to the present wall stacks.

Air is drawn from the basement through two filters by the air conditioner blowers and is discharged upward through an extended surface heat exchanger supplied with steam from the boiler. The air is then passed through humidifying screens and out into the duct system. Cold air from the living quarters is returned to the basement through grilles in the first floor.

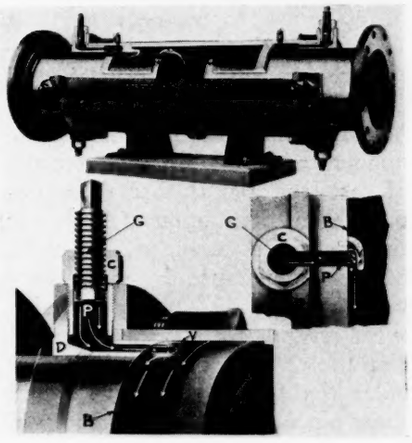
Units are built in a square sectionalized vertical cabinet, finished to harmonize with the oil furnace. The upper section, which may be detached from the lower and turned to face in any one of four directions, contains the heat exchanger, humidifier, and outlet manifolds for connection to the leaders. The motor, blowers, filters, and control box are contained in the lower section, which is mounted on pipe legs of sufficient length to permit direct connection of the leaders without elbows or angle fittings.

Air leaves the conditioner at approximately 145°, and is discharged from the registers at a temperature between 125° and 135°. The amount of air handled by the conditioner is said to be sufficient to permit recirculation of the entire volume of air in an average home from 5 to 10 times per hour.

Expansion Joints Can Be Packed While Line Is Under Full Pressure

Expansion joints which may be repacked while the steam line is under full pressure have been announced by Yarnall-Waring Co., Chestnut Hill, Philadelphia. The product has been designated the Yarway Gun-Pakt cylinder-guided expansion joint.

Plastic fibrous material is compressed into the stuffing-box by two or more pressure-gun cylinder units, depending upon the diameter of the



Yarway Gun-Pakt expansion joint

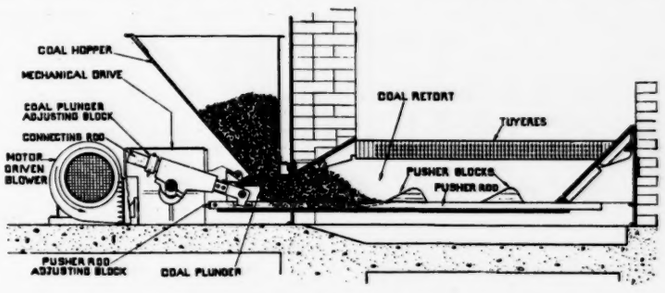
gland. These fittings comprise a threaded stainless steel plunger, G, which screws into a heavy cylinder, C, seated in the rim of the gland. D. When the plunger is turned up in the cylinder, the packing, P, is forced through a channel in the body of the gland, and an overhanging deflector vane, V, distributes it into the stuffing-box. These vanes cause the packing from each pressure gun to move around the gland space in the same clockwise direction, insuring uniform density of packing, and also serve as check valves to permit the removal of the plunger for recharging while the line is under normal pressure. The glands are of cast steel, and are similar to those using commercial coil packing, excepting that the Gun-Pakt glands are stationary, being securely bolted against the end of the expansion joint shell.

Packing material, developed expressly by the manufacturer to meet the requirements of this device, is made of long-fiber asbestos, combined with an inert material containing high-fire test mineral oil, and prepared in pellets shaped to fit the cylinder. Alemite grease fittings are provided in the body of the joint in the packing space to supply lubrication for the moving sleeve. The manufacturer states that these joints are suitable for pressures ranging from sub-atmospheric to the highest pressures used in modern steam heating practice.

Stoker Has Side Dumping Grates

Detroit Stoker Co., General Motors Building, Detroit, is manufacturing the Detroit LoStoker for automatic underfeed firing of heating boilers.

Unit can be either turbine- or motor-driven, and automatic control can be regulated by boiler pressure, water temperature, or room temperature. An adjustable rod connects the mechanical drive to the coal plunger, which reciprocates



Cutaway view of Detroit LoStoker

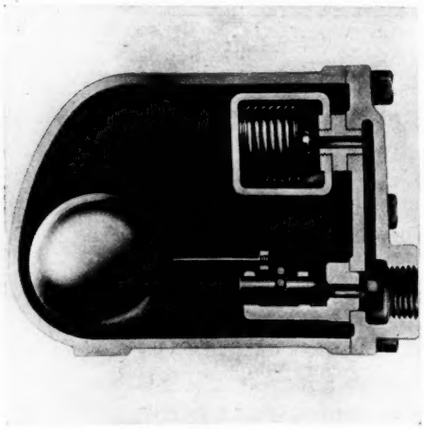
with a stroke varied to meet requirements. An agitator provided in the hopper insures that when the plunger moves outward a charge of fuel from the hopper falls in front of it. When the plunger moves inward, the coal is pushed into the bottom of a large sectional retort. The coal is uniformly distributed by a pusher rod and pusher blocks moving in the lower part of the retort and protected from the fire by fresh coal. As the coal is forced upward toward the hot surface of the fire, air supplied by the stoker fan mixes with the combustible gases driven off, and completely burns them on passing through the hot fuel bed.

As the fuel cokes and burns it passes to the dumping grates at the sides. Before these grates are dumped, air is admitted from the air chamber through dampered openings to insure complete burning of all combustible. Ash is removed through doors at the front.

Stokers are available with single dumping grates, or with double dumping grates. Twelve sizes, ranging in capacity from 3100 sq. ft. to 11,000 sq. ft. of steam radiation are made in the single dumping grate model, and 14 sizes ranging from 6000 sq. ft. to 27,000 sq. ft. of steam radiation are made in the double dumping grate model.

Float Trap with Thermostatic Air By-Pass

Sarco Co., Inc., 183 Madison Ave., New York, has announced the FT-0 float trap with thermostatic air by-pass. It is said to be particularly adapted for risers, mains, and unit heaters.



Float trap

All working parts are mounted on the cover and may be fully exposed for inspection and servicing by removing the trap body. The valve seat is spherical in shape to give maximum capacity. Inlet and outlet are separated by a vertical distance of but 2⅝ in. for horizontal piping and easy installation where head room is limited. Inlet and outlet tappings are ¾ in., but can be furnished in 1 in. sizes when specified. Discharge pressures range from 750 lb. to 4500 lb. per hr. at low pressures, and from 1100 lb. to 2800 lb. per hr. at high pressures.

Fairbanks, Morse Automatic Coal Burner

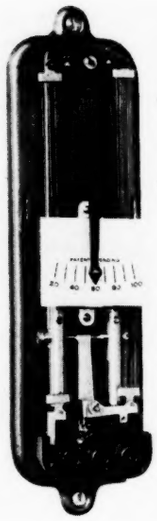
Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, is manufacturing a line of automatic coal stokers in a range of sizes to meet the heating requirements of practically any building from residential to large-size commercial structures.

Fuel charged into a large capacity heavy-gauge copper-bearing sheet steel hopper is conveyed to the retort by means of a heavy alloy steel feed screw, enclosed in a cast-iron housing connected to the base of the hopper and the retort. The retort is of cast iron and is shaped to promote even distribution of coal over the fire bed. A motor of Fairbanks, Morse manufacture drives the conveyor screw through a variable speed worm gear transmission, and also the centrifugal fan which provides the forced draft. A safety shear pin protects the mechanism in case of foreign matter jamming the conveyor. Access to the conveyor is afforded through a cleanout plate.

Ten sizes of stoker are available, ranging in coal-burning capacity from 30 lb. per hr. to 1200 lb. per hr. This will supply from 660 sq. ft. to 26,400 sq. ft. of direct steam radiation or equivalent.

Humidistat Accurate Over Wide Range

Julien P. Friez & Sons, Inc., Baltimore St. and Central Ave., Baltimore, Md., is manufacturing humidistats for control of humidifying or dehumidifying apparatus for air conditioning or process work. The control is made in two forms, either for wall mounting or for insertion into ducts, drying machinery, incubators, or similar apparatus.



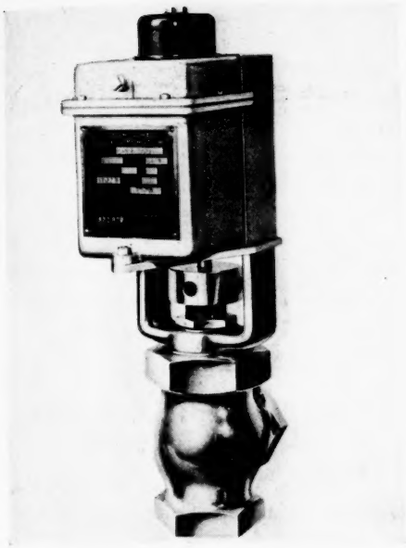
Friez humidistat with cover removed

Hygroscopic elements consist of 54 strands of human hair. These are said by the manufacturer to be free from appreciable variation in calibration, and have the added advantage of accurate operation up to the saturation point. The humidistat is ordinarily used as a three-wire instrument in conjunction with a suitable relay, thus insuring absence of chatter, but may also be used to make a pair of contacts at desired low or high humidity. It is suitable for the operation of either humidification apparatus or dehumidification apparatus separately or for the joint operation of both pieces of equipment from the same control. All wiring connections for either system are made from outside the cover, a moulded bakelite therminal block with simple arrangement for insertion of leads from bottom or back of base being provided for the purpose.

Operating differential is ordinarily 1% relative humidity, but adjustment can be made to increase this differential to any wider range desired. The instrument contacts will carry 25 watts at voltages up to 110.

Throttling Valves Operated Electrically

Barber-Colman Co., Rockford, Ill., has announced a line of small motor-operated throttling valves for



Barber-Colman electric throttling valve

service in applications requiring graduated valve control. The manufacturer recommends them as especially useful on air conditioning and small blast systems, and also on unit heaters and unit ventilators.

A small size reversing damper controller is mounted on a special bonnet fitted to the same type of body, disc, plunger, and gland assembly as is used for corresponding positive-acting valves. This motor operator imparts a positive longitudinal motion to the plunger sleeve through a cam. It can be stopped, restarted in the same direction, or reversed at any position between the fully opened or fully closed positions of the valve. Speed is adjustable after installation, and can be changed to meet varying requirements. Auxiliary switches are incorporated in the motor operator and from these it is possible to control other apparatus such as the subsequent valves on a blast system.

Valves are available in packed or packless models for either high or low pressure service. Sizes range from ½ in. to 2 in.

Stoker for Heating and Industrial Boilers

Combustion Engineering Corp., 200 Madison Ave., New York, is manufacturing the type E underfeed stoker suitable for application to both heating and industrial boilers in the approximate range of 40 to 150 boiler horsepower.

Fuel-feeding mechanism is of the ram or plunger type, and consists of a main plunger with auxiliary pushers mounted on a sliding plate reciprocating back and forth in the bottom of the retort. The grate surface is composed of stationary bars with moving elements or tuyeres which serve to agitate the fuel bed and promote air distribution. Standard equipment includes stationary plates on either side of the active grate surface, but these may be replaced by sectional-type shaking dump grates as optional equipment.

Control system, included as standard equipment, provides continuous adjustment of fuel feed and air supply over a wide range of load in addition to on and off control during banking periods. The stoker is driven by a constant speed motor, variation in fuel supply being effected by means of a timing device which regulates the number of strokes of the plunger per minute in accordance with the load requirements. The fan is integral with the drive, and is equipped with silent inlet dampers.

Units are manufactured in three sizes. These are designated class 3, built in projected grate areas of 9 sq. ft. to 17½ sq. ft.; class 4, with projected grate areas from 12 sq. ft. to 22½ sq. ft., and class 5, with grate areas from 15 sq. ft. to 27½ sq. ft.

Humidifier Attached to Smokepipe of Furnace or Boiler

Health-O-Mist Humidifier Mfg. Co., Columbus, Wis., has announced the Health-O-Mist humidifier utilizing the waste heat in the stack to evaporate water into air. It may be used with any steam or hot water boiler, or warm-air furnace.

Device consists of a rectangular copper tank containing a section of copper smoke pipe through which the hot gases from the boiler or furnace are passed before they are delivered to the chimney. A float valve maintains sufficient water in the tank to submerge the smoke pipe section, and the space above the water is connected to the living quarters by both flow and return ducts, terminating in grilles. Water in the tank is heated and adds both heat and moisture to the air circulated through it by natural convection.

New Equipment

"Genuine Detroit" Thermostat

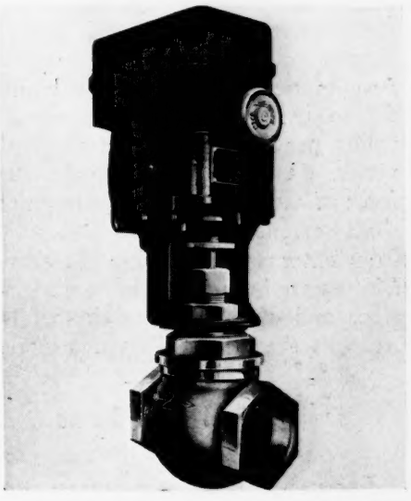
Detroit Lubricator Co., Detroit, Mich., is marketing the No. 444 thermostat, a low voltage instrument operating on the bi-metal principle. Extremely close control is said by the manufacturer to be possible, and adjustment is provided to widen the differential if desired.

Thermostats are finished in dull green, and are regularly supplied with a thermometer on the cover. The case is 2 in. x 5 in., and projects 1⅝ in. from the wall. The adjustment provides for settings between 55° and 85°. It will handle up to 25 volts, and will carry a load as high as 25 watts.

Motor-Operated Controllers

Automatic Temperature Control Co., Inc., 34 East Logan St., Philadelphia, is marketing the type 1 motor-operated controller for governing the flow of steam, air, gas, oil, or other fluids. The device can be actuated by any instrument having high and low contacts available on the market for the regulation of temperature, pressure, time cycle, level, flow, etc.

Controllers can be supplied with valves of the butterfly type or of the pilot piston type. The motor operates the driving screw through three spur gears to give a full stroke of ⅞ in. in approximately 2 sec., with a driving effort of 65 lb. for both opening and closing operations. The driving yoke is declutched at the completion of each stroke before



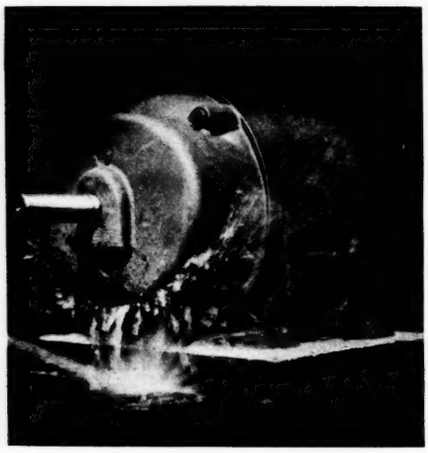
A. T. C. motor-operated controller

the motor comes to rest, insuring definite valve settings. The device is designed to function properly in any position.

Driving motors are completely enclosed, series-wound with split field, and can be supplied for 110 or 220 volts, alternating or direct current. The control may be applied to valves for as high as 250 lb. pressure. A hand wheel is provided for manual operation, and with single seat globe valves, an adjustment permits minimum settings up to 50% of capacity.

Motor Windings Protected from Splashed Water

A splashproof motor for use in locations where it may be subjected to splashing and dripping liquids has been placed on the market by The Louis Allis Co., Milwaukee, Wis.

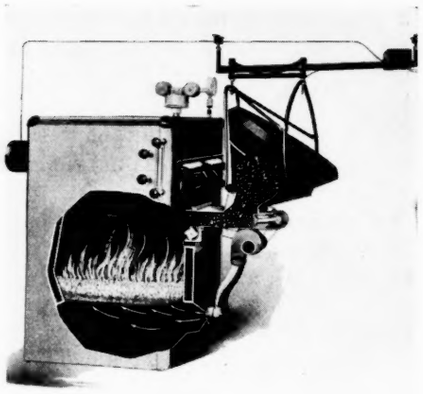


Louis Allis splashproof motor

A double baffle in an elliptically-shaped air passage in each endbell permits free passage of ventilating air to the interior of the motor, while preventing the entrance of water. A shaft guard breaks the force of a stream directed along the shaft extension, and prevents it from entering the bearing chamber. Motors are built in the same dimensions and with the same characteristics as the standard open motors.

Domestic Stoker Burns Low-Priced Fuel

For use in residential steam, hot water, and warm-air heating plants,



Cutaway view of Hannon stoker installation

The Murray Ohio Mfg. Co., Cleveland, Ohio, is marketing the Hannon coal stoker. The manufacturer states that slack and low-priced fuels can be burned successfully.

Installation of the device requires no alteration to the existing furnace or boiler equipment. A conical hopper of 200-lb. capacity, revolving on ball bearings, delivers coal to a piston plunger which charges it into the furnace through the fire-door opening, where a spreader distributes it over the fire bed. Draft is provided by a fan which discharges into the ash pit through a flexible tubing. A single motor drives the piston plunger, the spreader, and the draft fan, and the spreader speed and piston stroke can be varied to meet the requirements. The entire apparatus is suspended from a monorail and can be moved away from the heater to permit hand-firing in case of power failure, and to facilitate cleaning. Ashes may be conveniently removed from the ash pit by disconnecting the flexible draft tube.

Stoker is supplied in one model, said to be easily adjusted to all sizes of domestic heating plants. When running steadily it will feed from 12 lb. to 50 lb. of fuel per hour, depending on the adjustment.

Control Maintains Constant Combustion

Mason Regulator Co., 1190 Adams St., Boston, has announced the Mason differential draft control system. Of the instrument type, the controller regulates the amount of air passing through the furnace in accordance with the natural draft of the stack and the quantity of fuel consumed by controlling the speed of forced or induced draft blowers, by adjusting the inlet, uptake, or stack dampers, or by any other suitable means for controlling the flow of air to the furnace.

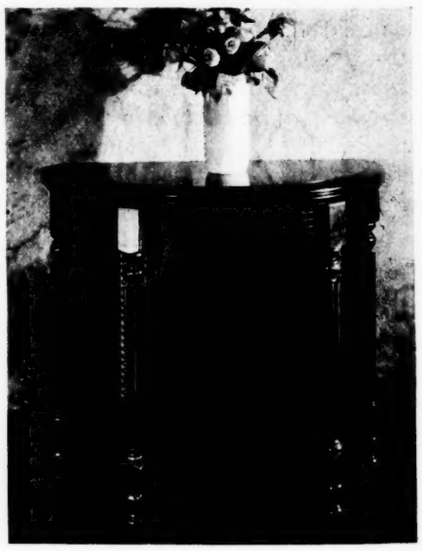
Operation is by compressed air, controlled by a sensitive pilot valve. The manufacturer states that the slightest variation in draft differential will regulate the blowers or dampers to maintain good combustion under varying conditions.

Non-Corrosive Solder Flux Applied by Brush

American Chemical Paint Co., Ambler, Pa., has developed a non-corrosive soldering flux known as Flosol Cream for use with sheet steel and most of the commonly-used metals, with the exception of aluminum and its alloys. The material is applied by brush to the metal to be soldered and the coated surface can be tinned or soldered before it dries. The manufacturer states that the film neither runs nor spreads upon being heated, and that the residue remaining after the soldering is confined to a restricted area from which it may be removed by a wet cloth. It is obtainable in 12-lb. tins and 60-lb. pails.

Humidifier Connected to Heating System

A domestic humidifier unit, called the Spring-Dawn, has been placed on the market by The Yost Co., International Building, St. Louis, Mo.



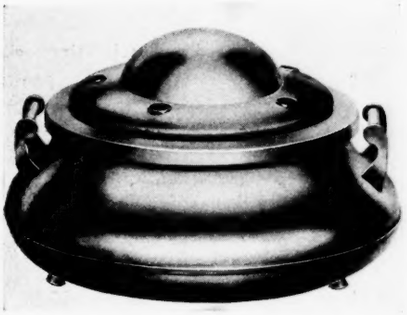
Yost Spring-Dawn humidifier

Hot water from a coil installed in the house-heating system is piped under city pressure to the humidifier, where it is cascaded down through a series of trays and evaporated. This evaporation is proportional to the temperature in the heating plant and to the demand for humidity. Surplus water is drained off to the sewer.

Cabinet is of attractively finished hardwood, 25¼ in. high, 26⅞ in. wide, and 14 7/16 in. deep. The manufacturer states that the unit is of sufficient capacity to maintain an average of 40% relative humidity in a residence having from five to nine rooms.

Humidifier Atomizes Water Mechanically

Walton Mfg. Co., Inc., 39 Central Ave., Newark, N. J., is marketing a portable humidifier for home, office, and similar applications.

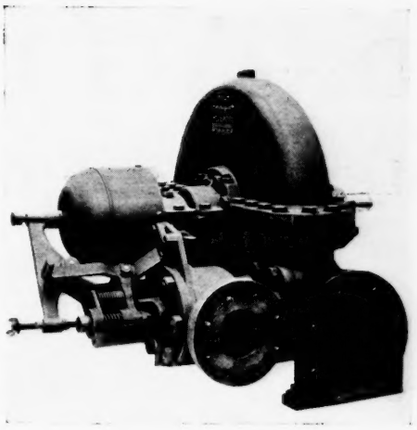


Walton humidifier

Water is raised from the reservoir in the lower part of the casing by centrifugal force, and is delivered to a revolving disc which spreads it into a thin film. This film is broken up into a fine mist by a series of slots against which it impinges. A fan on the motor shaft draws air in from outside the casing and discharges it, laden with finely atomized water, from the five apertures in the dome of the unit. The dome is so designed as to baffle the heavier drops of moisture, allowing only the fine mist to escape. It is constructed of solid copper and brass throughout, the standard finish being statuary bronze. Power consumption is approximately 40 watts.

Mechanical Drive Turbine for Pumps and Fans

General Electric Co., Schenectady, N. Y., has introduced the type D-59



G. E. mechanical drive turbine

mechanical drive non-condensing steam turbine for driving centrifugal pumps, fans, and other rotating equipment.

A single stage machine, the turbine has two rows of revolving buckets. The wheel casing is split horizontally to allow easy access to the internal parts. Steam and exhaust ports are connected to the lower half of the casing. A centrifugal governor regulates the speed, and an independent emergency governor provides safety control. This turbine is suitable for driving equipment at speeds ranging from 1200 r.p.m. to 4000 r.p.m., and is available in capacities up to 250 hp. under suitable steam conditions.

Electric Valve Controls Spray Humidifier

Supreme Electric Products Corp., 425 South Clinton Ave., Rochester, N. Y., is manufacturing an electrically-controlled spray-type humidifier for warm-air furnaces and air conditioning systems.

Moisture is introduced into the air in the form of a fog of water vapor in the free air space of the furnace where it is picked up by the heated air and carried to various parts of the house. This fog is created by the impact of a fine stream of water, under city pressure, against a baffle. A wall humidistat in the living quarters operates the electric valve to turn the water supply on or off. The valve may also be operated by a wall switch, or by a manual valve on the humidifier. At 50 lb. pressure the humidifier will add 20 lb. of water to the air in the home daily.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF HEATING AND VENTILATING, published monthly at New York, N. Y., for October 1, 1932.

State of New York, County of New York, ss.:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the Treasurer of The Industrial Press, publishers of Heating and Ventilating and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Industrial Press, 140-148 Lafayette St., New York, N. Y.

Editor, C. H. B. Hotchkiss, 140-148 Lafayette St., New York, N. Y.

Managing Editor, Clifford Strock, 140-148 Lafayette St., New York, N. Y.

Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

The Industrial Press, 140-148 Lafayette St., New York, N. Y.; Estate of Alexander Luchars, 140-148 Lafayette St., New York, N. Y.; Louis Pelletier, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.; Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Laura A. Brownell, 140-148 Lafayette St., New York, N. Y.; Franklin D. Jones, 140-148 Lafayette St., New York, N. Y.; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; Helen L. Ketchum, Atlantic Ave., Cohasset, Mass.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner: and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 21st day of September, 1932.

CHARLES P. ABEL

Notary Public
Kings County No. 210
Kings Register No. 3011
N. Y. County No. 15
N. Y. Register No. 3-A-6
My Commission Expires March 30, 1933.

Degree Days and Unit Fuel Consumption in Typical Cities

October, 1932

UNIT fuel consumption figures given below must be corrected for efficiency, heat content of fuel other than that listed below, for radiation emitting other than 240 B.t.u. per hr., and for radiation calculated on a basis other than zero outside to 70° inside.

Coal is assumed as having a heat content of 12,000 B.t.u. per lb., gas, 1000 B.t.u. per cu. ft., and oil, 140,000 B.t.u. per gal. To correct for other heating values, multiply the fuel consumption listed under the charts by the standard heat content just listed, and divide by the heat content of the fuel actually being used in the installation being calculated.

For radiation installed for any other outside temperature than zero, multiply the fuel consumption given under the charts by 70°, divided by the quantity (70 minus the outside temperature used).

To correct for efficiency, divide the fuel consumption by the efficiency of the heating installation.

For water radiation, multiply the fuel consumption which is given for steam radiation by 5/8.

	New York	Seattle	San Francisco	Chicago	Denver	Boston	St. Louis	Pittsburgh	Minneapolis
Degree days	244	345	103	392	509	273	254	299	580
Total degree days since September 1	292	487	205	477	605	346	277	371	717
Lb. of coal per sq. ft. of radiation for October	1.952	2.760	0.824	3.136	4.072	2.184	2.032	2.392	4.640
Gal of oil per sq. ft. of radiation for October	0.167	0.237	0.071	0.269	0.349	0.187	0.174	0.205	0.398
Cu. ft. of gas per sq. ft. of radiation for October	23.42	33.12	9.89	37.63	48.86	26.21	24.38	28.70	55.68

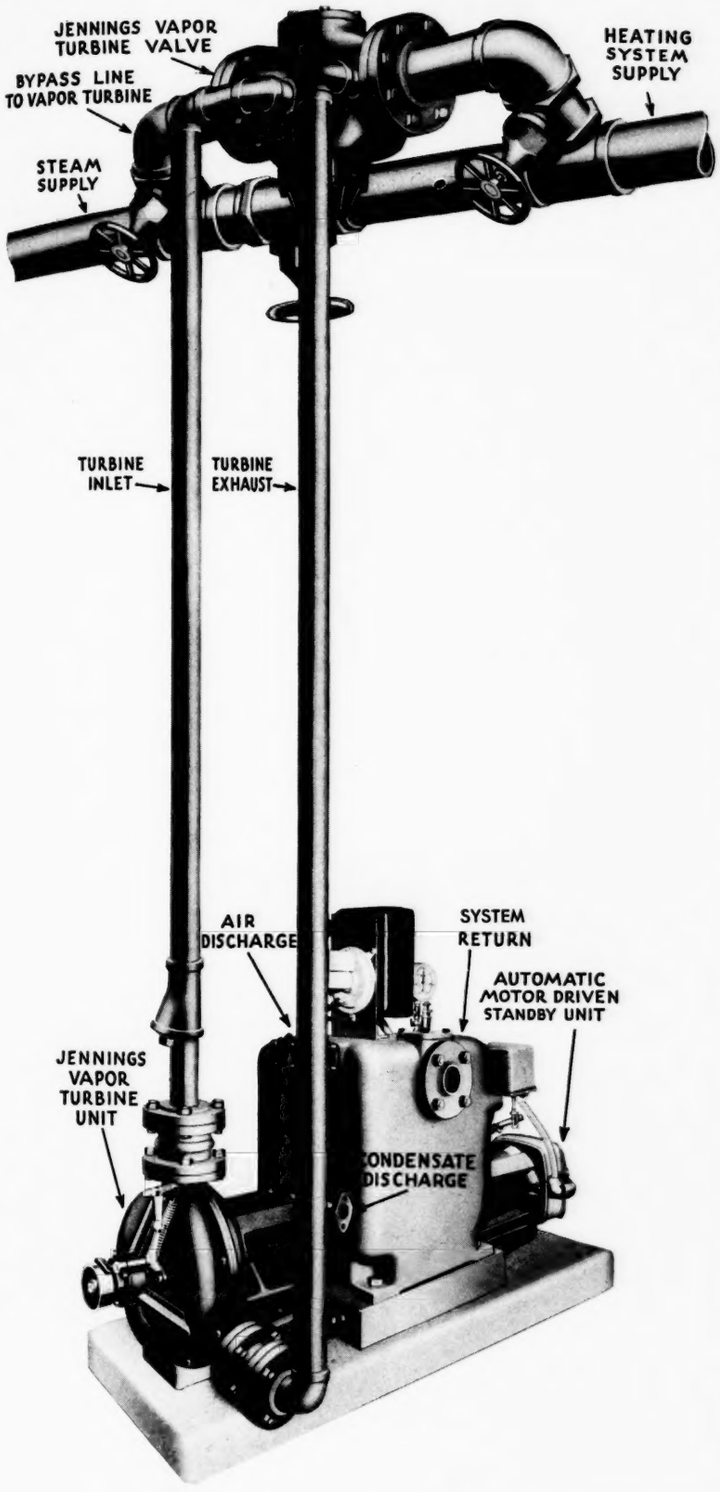
	Los Angeles	Baltimore	Philadelphia	New Orleans	Atlanta	Cleveland	Cincinnati	Detroit
Degree days	14	212	194	32	133	316	286	376
Total degree days since September 1	14	231	218	32	147	381	342	459
Lb. of coal per sq. ft. of radiation for October	0.112	1.696	1.552	0.256	1.064	2.528	2.288	3.008
Gal. of oil per sq. ft. of radiation for October	0.010	0.145	0.133	0.022	0.091	0.217	0.196	0.258
Cu. ft. of gas per sq. ft. of radiation for October	1.34	20.35	18.62	3.07	12.77	30.34	27.46	36.10

	Buffalo	Birmingham	Indianapolis	Memphis	Des Moines	Kansas City	Louisville	Galveston
Degree days	361	120	325	146	463	317	248	16
Total degree days since September 1	477	120	387	150	550	348	275	16
Lb. of coal per sq. ft. of radiation for October	2.888	0.960	2.600	1.168	3.704	2.536	1.984	0.128
Gal. of oil per sq. ft. of radiation for October	0.248	0.082	0.223	0.100	0.317	0.217	0.170	0.011
Cu. ft. of gas per sq. ft. of radiation for October	34.66	11.52	31.20	14.02	44.45	30.43	23.81	1.54

Fuel consumption figures must be corrected for local conditions as explained above.

THE NEW JENNINGS HEATING PUMP

THAT OPERATES DIRECTLY FROM THE SYSTEM STEAM.



Here is a return line heating pump meeting the modern demand. The Jennings Vapor Turbine requires no electric current. It operates on steam directly from the heating mains, and returns that steam to the heating system with practically no heat loss. Electric current, the one biggest item in the cost of operating a return line heating pump has been eliminated.

This pump operates on any form of return line heating system, regardless of type of control on the steam supply. It functions equally well on low pressure steam, on high pressure steam thru reducing valve, or on street steam. It makes no difference whether the system is run above or below atmospheric pressure, because the turbine operates on the differential between the supply and the inlet, and not on a pressure above atmosphere.

Sturdy and simple in construction, this pump has all of the advantages that have made Jennings Heating Pumps a "buy" word to American Engineers. They have the exclusive Jennings feature of separation under vacuum, air and water being handled separately in pumping elements designed for each. Balanced bronze rotors rotate on high grade ball bearings without metallic contact with the casing.

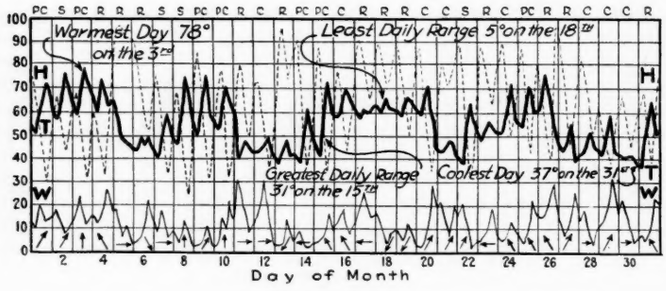
Send to-day for Bulletin 203 describing this remarkable pump in detail.

NASH ENGINEERING CO.
SOUTH NORWALK, CONN., U. S. A.

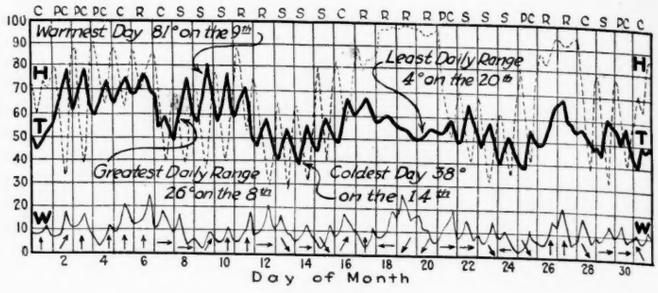
Jennings Pumps

The Weather

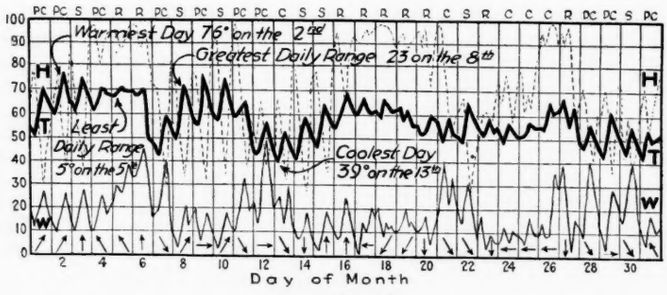
October, 1932


Warmest Day 78° on the 3rd
Least Daily Range 5° on the 18th
Greatest Daily Range 31° on the 15th
Coolest Day 37° on the 31st
Day of Month

Pittsburgh

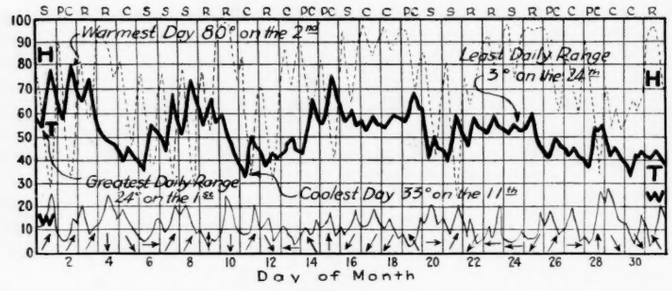

Warmest Day 81° on the 9th
Least Daily Range 4° on the 20th
Greatest Daily Range 26° on the 8th
Coldest Day 38° on the 14th
Day of Month

Boston

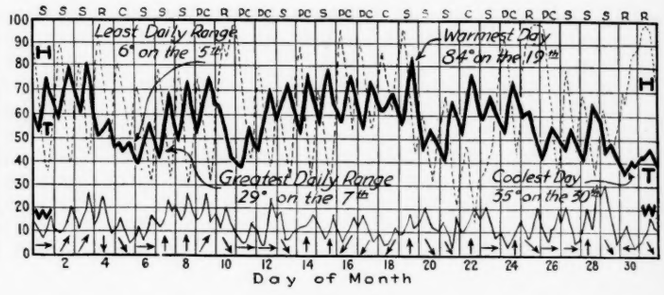

Warmest Day 76° on the 2nd
Greatest Daily Range 23 on the 8th
Least Daily Range 5° on the 5th
Coolest Day 39° on the 13th
Day of Month

New York

(Hourly observation of the Relative Humidity Plotted on this Chart)


Warmest Day 80° on the 2nd
Least Daily Range 3° on the 24th
Greatest Daily Range 24° on the 1st
Coolest Day 35° on the 11th
Day of Month

Chicago


Least Daily Range 6° on the 5th
Warmest Day 84° on the 19th
Greatest Daily Range 29° on the 7th
Coolest Day 35° on the 30th
Day of Month

St. Louis

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	76	81	78	80	84
Date of highest temperature	2	9	3	2	19
Lowest temperature, deg. F.	39	38	37	33	35
Date of lowest temperature	13	14	31	11	30
Greatest daily range, deg. F.	23	26	31	24	29
Date of greatest daily range	8	8	15	1	7
Least daily range, deg. F.	5	4	5	3	6
Date of least daily range	5	20	18	24	5
Mean temperature for month, deg. F.	57.6	57.1	55.5	52.6	57.4
Normal mean temperature for month, deg. F.	56.3	53.6	55.6	54.0	58.8
Total precipitation, this month, inches	5.03	7.18	2.79	3.52	4.28
Total snowfall, this month, inches	0	0	0	Trace	0
Normal precipitation, this month, inches	3.53	3.15	2.52	2.53	2.72
Total wind movement, this month, miles	11,373	7179	8398	8576	9435
Average hourly wind velocity, miles	15.3	9.6	11.3	11.5	12.7
Prevailing direction of wind	N.W.	W.	S.W.	S.W.	S.
Number of clear days	7	6	5	7	20
Number of partly cloudy days	10	12	12	8	4
Number of cloudy days	14	13	14	16	7
Number of days with precipitation	9	9	12	11	7
Number of days with snowfall	None	None	None	None	None
Snow on ground, at end of month	None	None	None	None	None

Plotted from records especially compiled for HEATING AND VENTILATING by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 a. m., 12 m., and 8 p. m. Arrows fly with prevailing directions of wind.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.

Engineering
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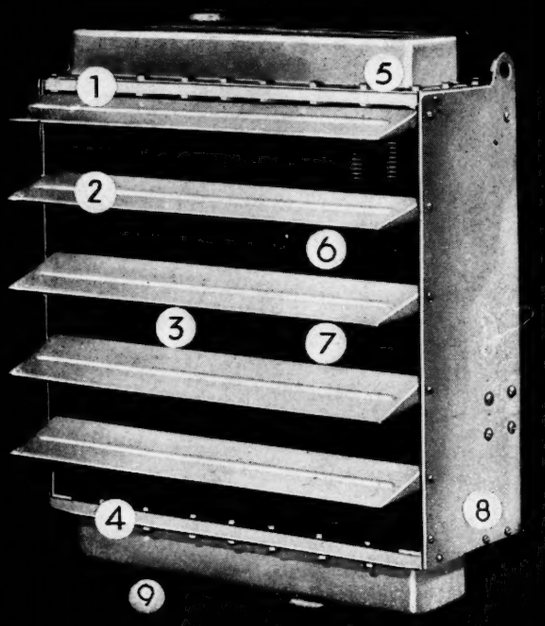
Heating and Ventilating

INTERNATIONAL EXPOSITION SUPPLEMENT

1932

McCORD Unit Heaters Introduce New Standards of Heating Efficiency



IN feature after feature, McCord Unit Heaters present dominant advantages in accessibility and performance. A new type of wider copper fin spirally wound around tinned copper tubes provides heat dissipating capacity unequalled in any other unit heater of comparable size. Every part—motor, spiral copper fin tubes, tanks, shutters—can be easily and quickly disassembled. Compare the features shown on this page with what others offer. Then write at once for the McCord Unit Heater Catalog and order a stock of McCord Unit Heaters.

1. Extra heavy header plates.

2. Adjustable louvers.

3. Individual spiral fin tubes — removable for inspection or replacement.

4-5. Tanks are bolted to header plates, removable for cleaning.

6. Tubes are scientifically spaced, result: air resistance low.

7. Extra wide fins tightly joined to tubes by special tinning process—better heat conductivity.

8. Attractive green lacquer finish.

9. Entire unit heavily tinned inside and out. Tested for 125 pounds working steam pressure.

10. Scientific design of fan shroud makes for efficiency.

11. Fan removable without disturbing motor.

12-13. Two point motor support—no strain on tanks.

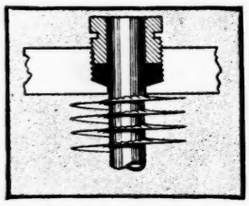
14. Standard makes of unit heater motors supplied.

15. Balanced suspension — no strain on steam pipes.

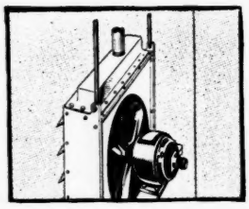
16. Extremely quiet balanced fan.

17. Clean cut appearance.

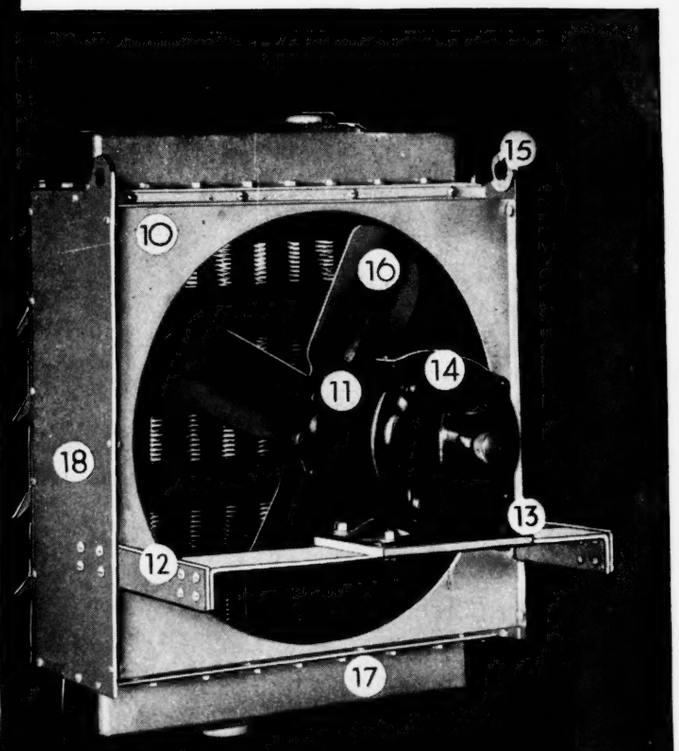
18. Heavy side plates support motor and fan independent of tanks.



COMPRESSION NUT MAKES TIGHT JOINT



BALANCED SUSPENSION REDUCES VIBRATION



UNIT HEATER DEPARTMENT

McCORD

RADIATOR & MFG. CO. - DETROIT, MICH.

But Two Short Years

An Editorial

IT IS but two years since the initial exposition was held, yet how different the picture is, and how things have moved. It scarcely seems possible that so many developments could be compressed into so short a time.

Two years ago we had just come through the distressing period which accompanied the collapse of the boom. Some were sure that the readjustment period would be short and that business would soon resume its upward sweep of volume. Probably few would have been so pessimistic that they would have believed that January, 1932, would find us still waiting for that expected upturn.

Then, many of us marveled at the range and diversity of products and apparatus shown, many of which were the fruit of work started during the period when building activities reached their peak. They were developed and brought out with the expectation that the volumes of the boom years would continue. They represented the faith of their makers in the immediate future.

The two years have been disappointing—not to say exasperating. They have brought trials such as business has had to pass through but seldom. Not only this, but signs of improvement have proved but passing fancies. Discouragement has followed discouragement, and volumes and profits have shrunk.

•

In the face of such difficulties who could be blamed for losing faith? Many have. Not so the manufacturers in this field. They have held to their course of keeping abreast of developments.

While these two short years have been poor in profits, they have been rich in the growth and development of ideas. Air cooling has grown by leaps and bounds. Home builders, especially, have learned that new and wonderful apparatus is available for their use; that dry and dirty air need not be tolerated; and that they may trust the operation of their plants to automatic servants. Fuels have been increasingly adapted to their best possible uses, and so wide a range of both fuel forms and apparatus are at hand that choices are coming to be made which would scarcely have been dreamed of but a few years past. The prevention and control of noise have come to be rightly regarded as being closely related to the heating and ventilating function. Heat insulating materials have found increasing acceptance and their close relation to both heating and cooling has come to be better understood. The idea that the heat should be applied and confined to the occupied space has found application in devices for delivering it as required. Use of power-driven means for securing control of the heating medium has come along so rapidly that wide application is almost wholly a matter of the past years' growth.

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Now, with these developments the products displayed again represent the faith of their makers in the immediate future; however, many of them are the result of efforts put forth in a time of shrinking business. How much more faith and hope they must thus express!

Now, these products are presented with full knowledge of the risks which must be faced, the gauntlet of criticism to be passed, the increased pressure of competition, and the increasing care with which buyers scrutinize their purchases. A product has to be doubly good to succeed now. But under these conditions every purchaser is doubly assured that every individual product represents the very acme of effort of its sponsors.

Not for years, if ever, have such values been presented. Never before have some of the ideas been reduced to concrete form, and made available for ready use. Truly there are mechanical wonders to be seen, but no mechanical wonders can compare with the wonder of spirit shown.

Will the faith of these manufacturers be justified? There can be but one answer—it will. This industry whose products are year by year becoming more and more important in building, cannot be kept back for any extended period. To believe that the present trouble is anything but passing is to believe that population growth will stop or that standards will fall.

When two short and discouraging years are so packed with encouraging developments, it can but mean that this industry is not in the depths—rather it is but gathering its forces and preparing itself for the coming years which will be even more crowded.

SECOND INTERNATIONAL HEATING AND VENTILATING EXPOSITION SUPPLEMENT,
published by HEATING AND VENTILATING, 148 Lafayette St., New York, N. Y.
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Jennings Pumps serve 44 buildings . . .

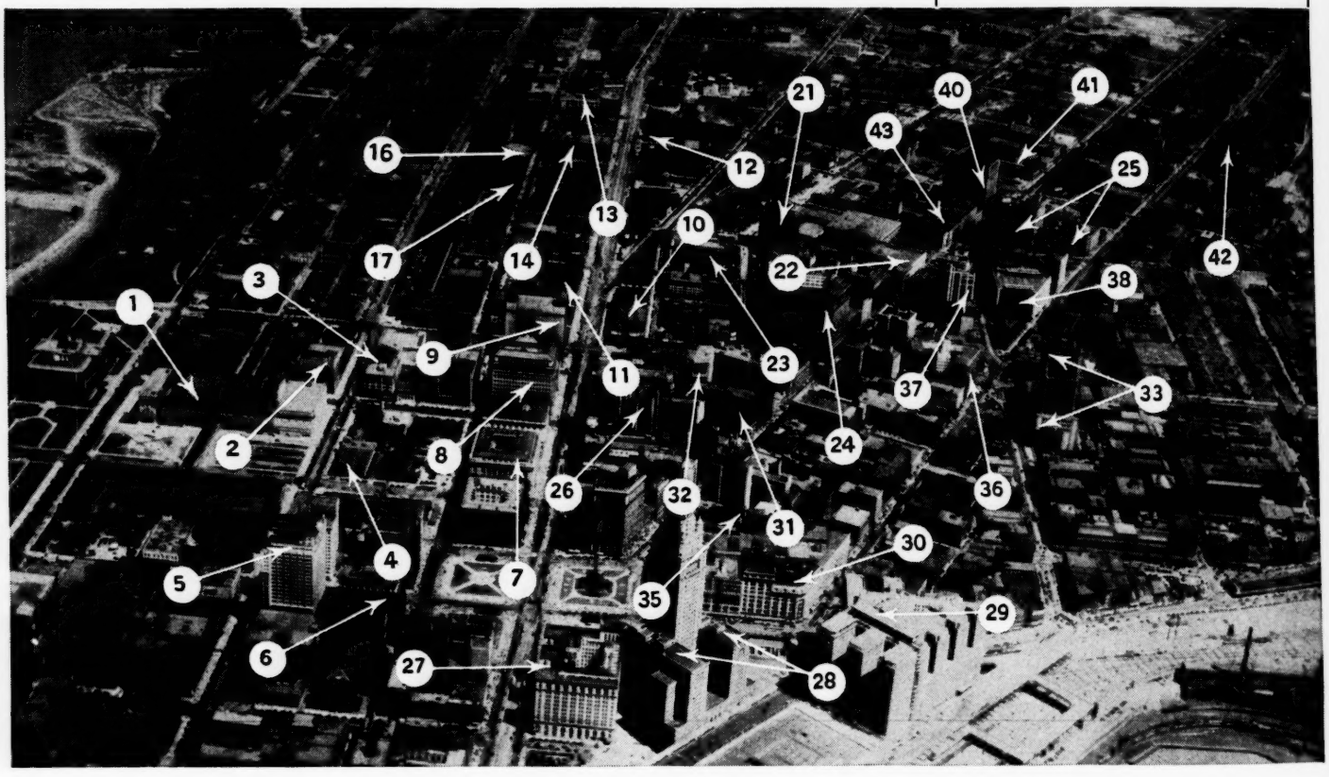
in this section of Cleveland

IN Cleveland, as elsewhere, architects, engineers, and building owners recognize the superiority of Jennings Pumps for building service. Forty-four Jennings-equipped buildings in Cleveland's business section alone bear evidence to this effect.

Jennings Vacuum Heating Pumps, Condensation Pumps, Centrifugal Pumps, Sump Pumps and Sewage Pumps have earned a reputation for long and efficient service.

1. Cleveland Public Auditorium
2. Auditorium Hotel
3. Auditorium Hotel Garage
4. Board of Education Building
5. Standard Bank Bldg.
6. Cleveland Electric Illuminating Co.
7. Cleveland Public Library
8. Federal Reserve Bank Building
9. Cleveland Discount Building
10. Superior-Ninth Building
11. Bryant Building
12. Catholic Young Women's Hall
13. Cleveland News
14. Morgan Lithograph Co.
15. Evangelical Building
16. Cleveland Police Station
17. County Court and Jail
18. Warner Bros. Film Exchange
19. May Company Warehouse
20. Elks Club
21. Allerton Hotel
22. Higbee Company
23. Hanna Building Garage
24. Union Trust Building
25. Leader Building
26. Hotel Hollenden
27. Hotel Cleveland
28. Cleveland Union Station
29. Builders Exchange
30. May Company Building
31. Arcade Hotel
32. Wm. Taylor & Son Company
33. Ohio Bell Telephone Company
34. Central United National Bank
35. 341 Euclid Building
36. Rose Building
37. Halle Bros. Company
38. Carnegie Hall
39. Hanna Building
40. Keith Building
41. First Baptist Church
42. Y. M. C. A.
43. Bulkley Building
44. Widlar Building

Aerial photo of the business section of Cleveland, Ohio. Cleveland Aerial Surveys, Inc.

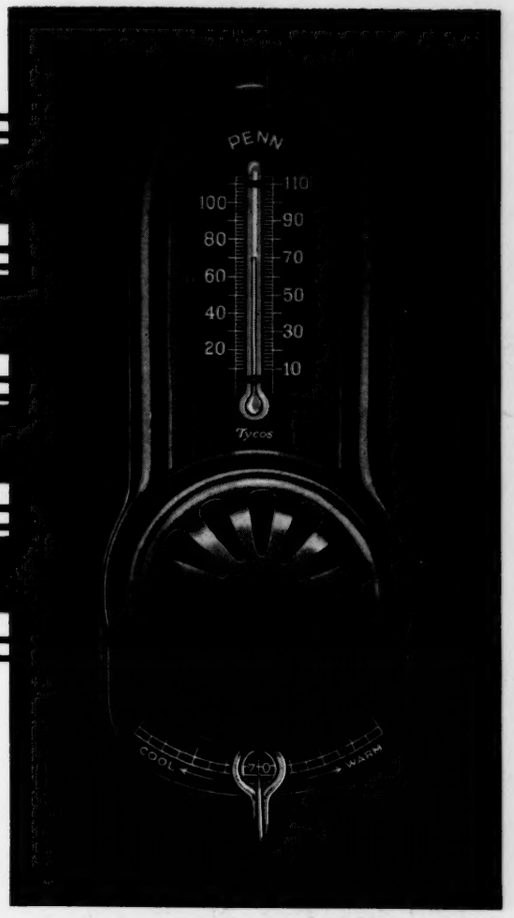


NASH ENGINEERING COMPANY, 81 WILSON ROAD, SOUTH NORWALK, CONN.

Jennings Pumps

PENN

Automatic Controls *for* Heating-Ventilating Refrigerating Air Conditioning



TYPE A ROOM THERMOSTAT
One of several high voltage Thermostats in the Penn simplified line.

Modern Simplicity
Unusual Accuracy
Outstanding Performance

Penn engineers pioneered simplicity in automatic controls. We introduced and are continuing to introduce a new high standard of performance and accuracy.

We offer you a complete line for all standard applications in the fields of heating, ventilating, refrigerating, and air conditioning. You will find each switch compact, easily installed, highly perfected, and dependable for years of true performance.

To work out special applications and new developments, all the facilities of our laboratories and the services of our own trained control specialists are at your disposal. We invite you to consult us at any time.

You are cordially invited to visit our booth Nos. 87-89 at the Cleveland Show, Jan. 25 to 29. A complete line of samples will be shown and competent engineers will be available to discuss your problems with you.

All Penn Switches are Listed as Standard by Underwriters' Laboratories, Inc.

PENN ELECTRIC SWITCH CO.
DES MOINES, IOWA

With Offices in New York, Boston, Buffalo, Cincinnati, Detroit, Chicago, Milwaukee, Minneapolis, St. Louis. On the West Coast, San Francisco, Los Angeles, and Seattle. Foreign Offices, Barcelona, Spain, London, England, Osaka, Japan, Lyons, France, and Wellington, New Zealand.

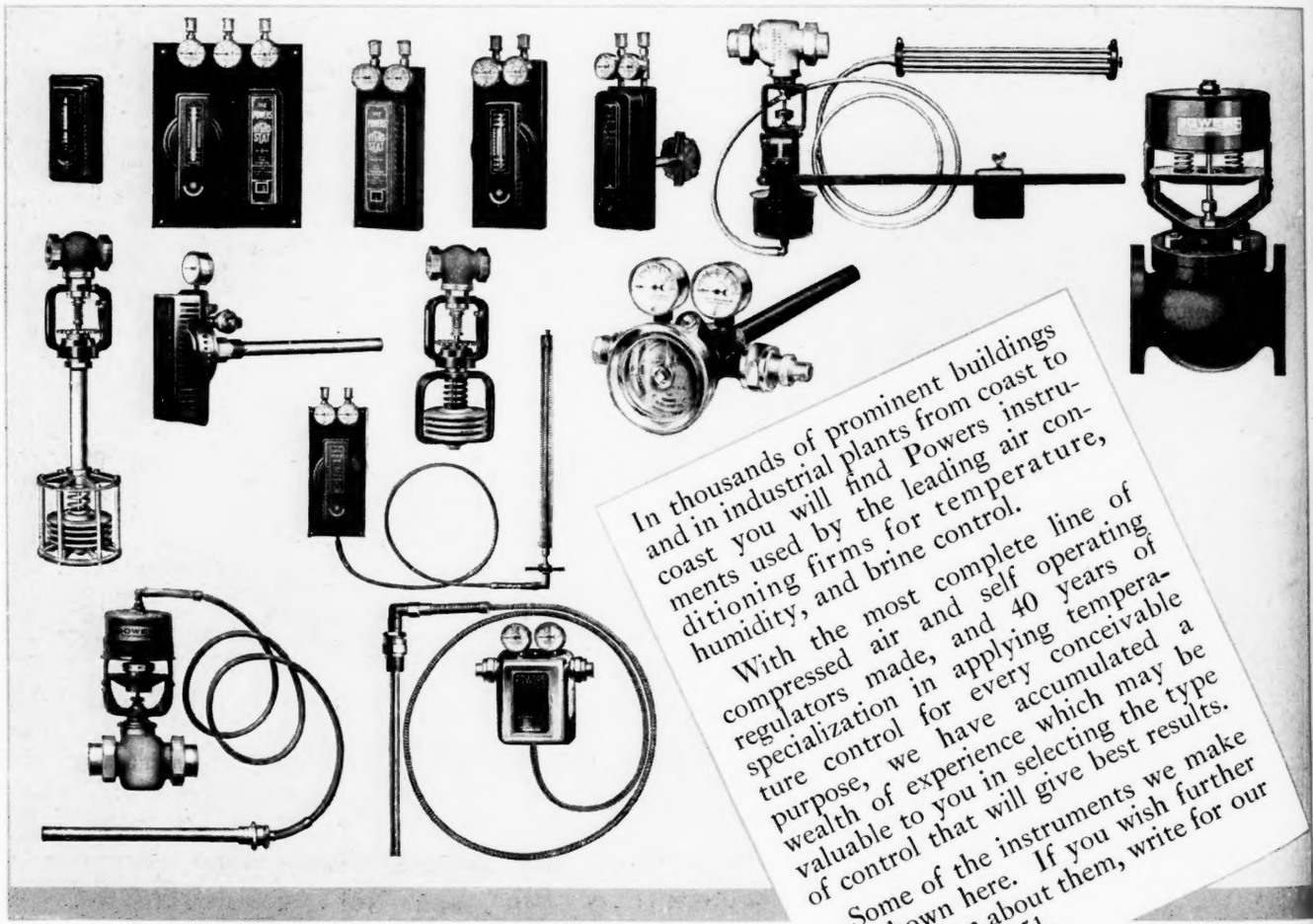
Specify
PENN SWITCHES

If

IT'S AIR CONDITIONING CONTROL *SEE*

POWERS

INSTRUMENTS for CONTROLLING AIR CONDITIONING EQUIPMENT



In thousands of prominent buildings and in industrial plants from coast to coast you will find Powers instruments used by the leading air conditioning firms for temperature, humidity, and brine control.

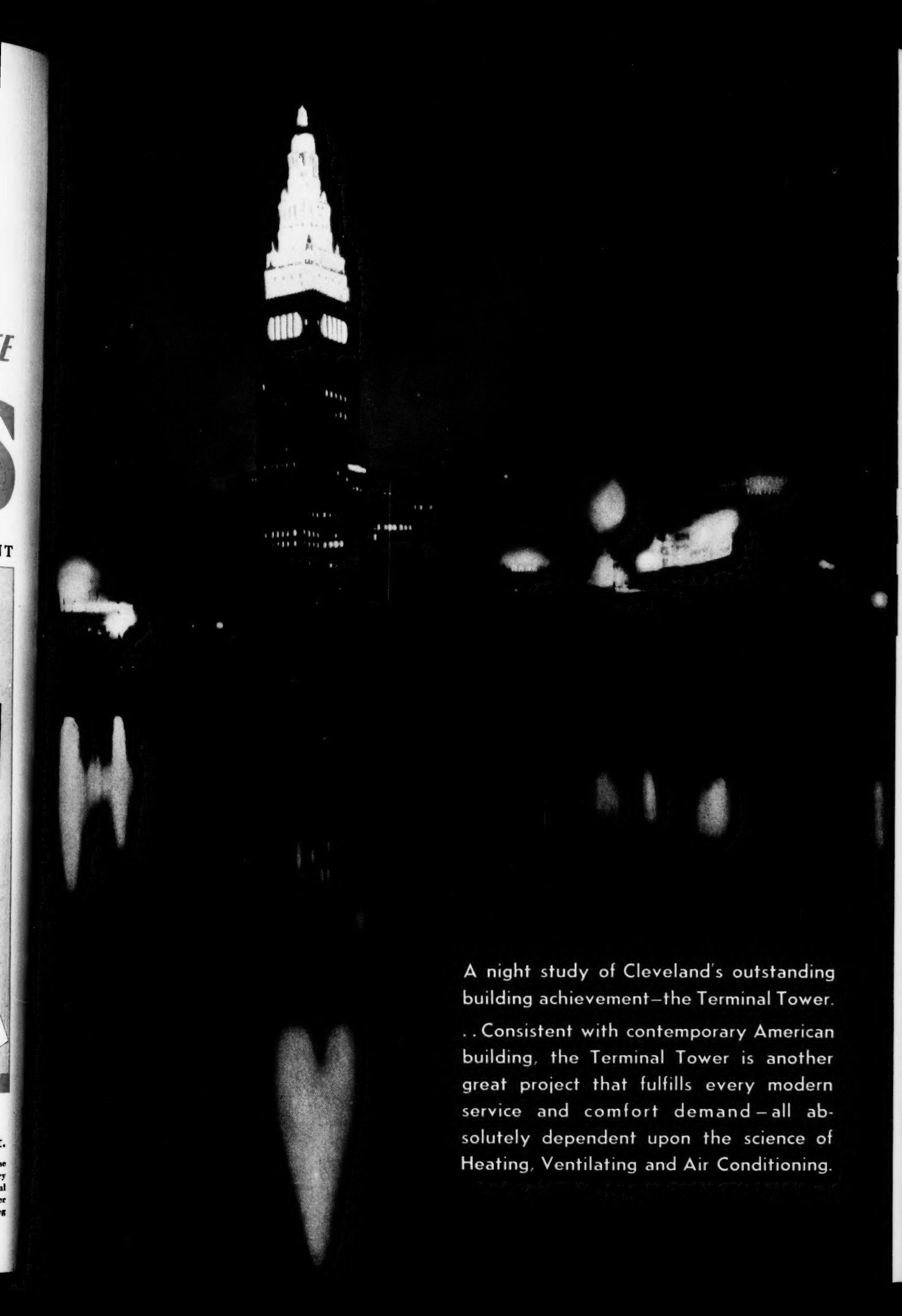
With the most complete line of compressed air and self operating regulators made, and 40 years of specialization in applying temperature control for every conceivable purpose, we have accumulated a wealth of experience which may be valuable to you in selecting the type of control that will give best results. Some of the instruments we make are shown here. If you wish further information about them, write for our Bulletin No. 251.

THE POWERS REGULATOR COMPANY

40 years of specialization in temperature control.

CHICAGO: 2718 Greenview Ave. NEW YORK: 231 E. 46th St. *Offices in 43 Cities* TORONTO: 106 Lombard St.

Atlanta	Butte, Mont.	Columbus, O.	El Paso	Los Angeles	New Orleans	Rochester	Syracuse
Baltimore	Charlotte, N. C.	Dallas	High Point, N. C.	Memphis	Philadelphia	St. Louis	Calgary
Birmingham	Chattanooga	Davenport, Ia.	Houston	Milwaukee	Pittsburgh	Salt Lake City	Montreal
Boston	Cincinnati	Denver	Indianapolis	Minneapolis	Portland, Ore.	San Francisco	Vancouver
Buffalo	Cleveland	Detroit	Kansas City	Nashville	Reading, Pa.	Seattle	Winnipeg



A night study of Cleveland's outstanding building achievement—the Terminal Tower.

. . Consistent with contemporary American building, the Terminal Tower is another great project that fulfills every modern service and comfort demand—all absolutely dependent upon the science of Heating, Ventilating and Air Conditioning.

MERCOID
AUTOMATIC CONTROLS

LET MERCOID CONTROLS Demonstrate Their Particular Advantages On Your Control Requirements « « « « «

THE Mercoid Line of Controls are used as standard on leading heating and ventilating equipment, employing stokers, oil burners, unit heaters, fans and blowers.

Mercoid Controls have grown up with the automatic heating and ventilating industry. They are produced with a background of wide experiences gathered over a long period of years in developing and working out various control problems.

In this respect, the Mercoid organization has been the pioneer in this field, and is therefore, thoroughly conversant with all automatic control requirements.

Mercoid Controls give you the assurance that experience alone has to offer.

They are the cheapest to use because they economize on service expense.

Their unfailing performance creates the kind of satisfaction that promotes good will.

If you have any special control problem, we offer the services of our engineering force in assisting you.

NO EXPOSED CONTACTS

The Mercoid Switch

A dominant feature of all Mercoid Controls, is that the contacts are enclosed. There can be no open arcing or corrosion of the contacting surfaces. These switches are the latest development in mercury tubes. They will operate indefinitely without any deterioration.

Mercoid Controls are listed as standard by the Underwriters' Laboratories Incorporated.

We invite your inquiries.

THE MERCOID CORPORATION

Sole Manufacturers of The Mercoid Switch

4201 BELMONT AVENUE • • CHICAGO, ILLINOIS

Some of the Leaders

No. 855 Thermostat

This instrument is distinctive in design and construction. The thermal element which is exposed directly to the air is filled with a volatile liquid, is very sensitive, responding quickly to all room temperature changes. It is simple, positive and dependable in operation. Extensively used on unit heaters.

Figure 31 Pressure Control

Mercoid Boiler Controls have been in use for many years as safety limiting devices on steam boilers fired by automatic oil burners or stokers. They employ a bourdon tube that actuates a snap action movement which gives a positive "make" and "break" in the circuit.

SMI Pyratherm

A complete Stack Safety Control with ignition cut-off, used on all burners having intermittent spark or gas ignition. It provides positive protection against flame or ignition failure. Absolute safety against delayed ignition is also insured in case flame is extinguished.

Figure 35 Risertherm

A temperature limiting control which can be attached to the risers of hot water heating systems, where oil burners or stokers are used. The attachment mechanism is interchangeable so that the control may be mounted on either a horizontal or vertical riser. It is simple to adjust and easy to install.

Figure M-53 Fan Control

This device is a new departure in control construction. It employs a unique gravity locking mechanism; indicates the temperature in the furnace hood and has a temperature calibrated dial and double adjustment, which makes it easily adaptable to all operating conditions. May be used with all types of fans and blowers for warm air furnaces.

Type M-51 Furnace Control is similar in construction and is used as a limiting device to prevent the overheating of warm air furnaces.

Type TU

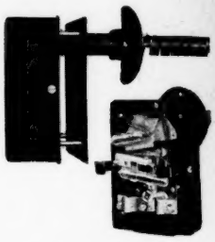
Consists of a combined incandescent ignition and safety control system, the most complete and highly developed equipment ever offered to the trade. The Type TU Incandescent and Ignition System is meeting with remarkable results.

Figure 36 Immersion Type Control

The most reliable control to use as a safety limiting device on hot water boilers. Simple in construction, easy to adjust and unsurpassed for dependable performance. A new wide adjustable range is now available in back angle type, which has a close differential and which can be employed on steam boilers without injury for controlling indirect water heaters.

Figure 71 Low Water and Pressure Control

A very desirable safety control equipment for automatically fired steam boilers. It guards against the hazard of firing into a dry boiler or building up excess pressure. Also furnished as Low Water Cut-out only.

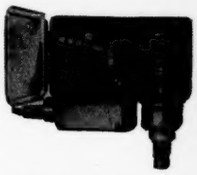


SM Pyratherm

A Stack Safety Control used for oil burners having constant ignition or constant gas pilot, or separate ignition control.

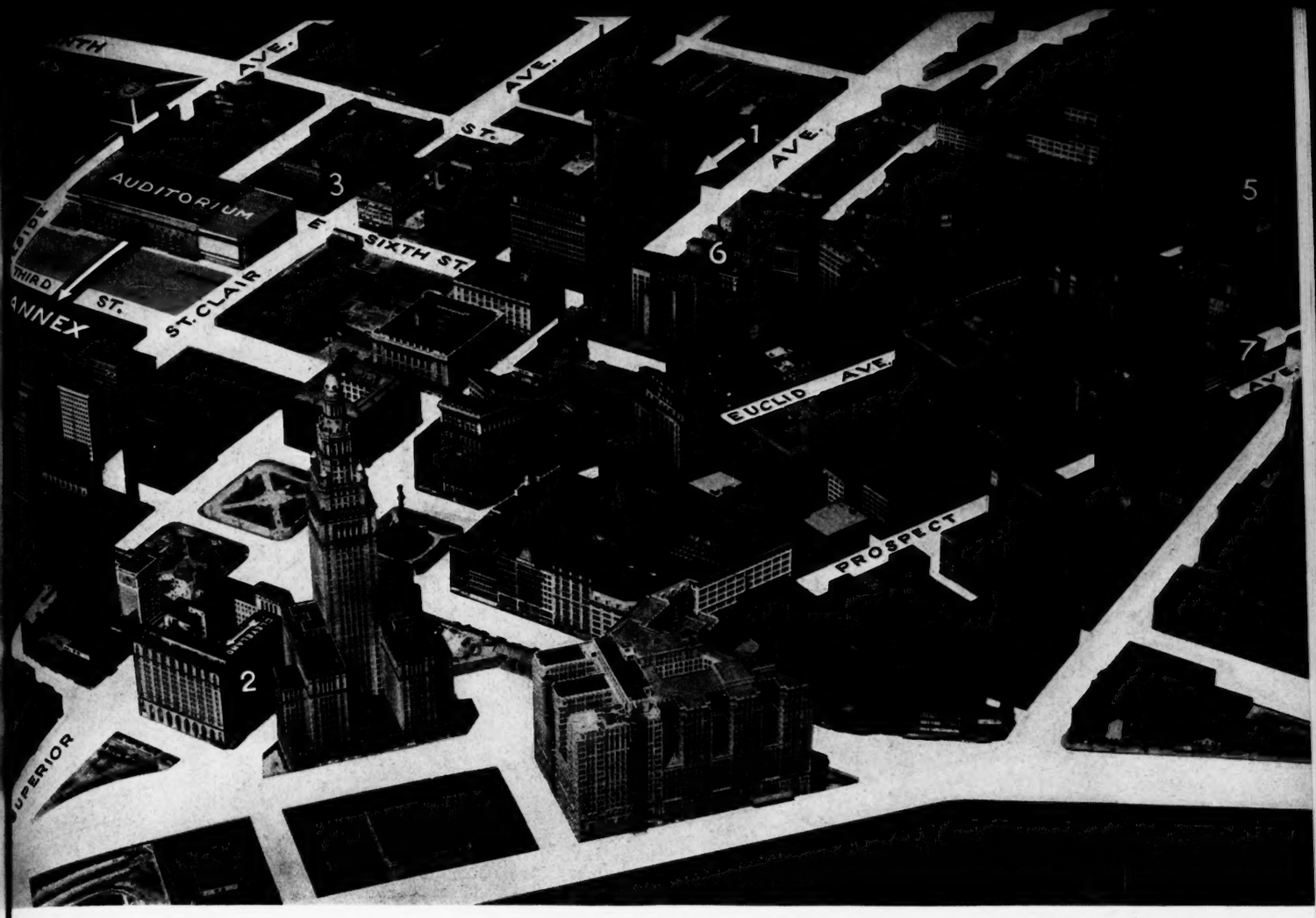
Model AA-3 Pressure Control

Particularly adapted for use on low pressure steam or vapor vacuum boilers that are automatically fired. Close and accurate control can be secured anywhere from 10" vacuum to 15 lbs. pressure. It has external double adjustment features that save time and labor at installation.



No. 848 Pressure Control

A popular pressure control. Generally used where close and accurate control is desired. This type of control is also furnished to give close regulation for pressures up to 400 lbs.



Fairchild Aerial Surveys, Inc.

DOWNTOWN CLEVELAND

1. OLMSTED HOTEL
2. HOTEL CLEVELAND (TERMINAL TOWER TO THE RIGHT)
3. AUDITORIUM HOTEL
4. CLEVELAND ATHLETIC CLUB
5. STATLER HOTEL
6. HOLLENDEN HOTEL
7. WINTON HOTEL
8. TO THE STADIUM

THE above airplane photo is looking in a general northerly direction. The Second International Heating and Ventilating Exposition will be held in the Auditorium Annex shown to the left. The majority of the meetings of the American Society of Heating and Ventilating Engineers will be held in the Statler Hotel, but a few will be held in the Cleveland Auditorium. Meetings of the American Society of Refrigerating Engineers will be held in the Hotel Cleveland.

The large building in the center foreground is made up of three units—The Midland Bank, Builders Exchange, and Medical Arts Building.

The Post Office is located at the intersection of East Third Street and Superior Avenue, shown on the map behind the dome of the Terminal Tower. The Public Library is across Third Street.

The building in the extreme upper left corner is the Cleveland City Hall.

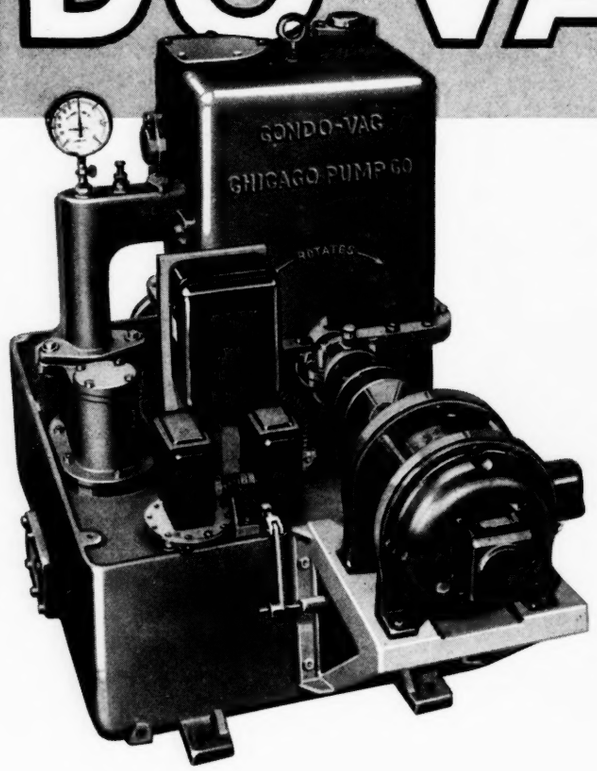
The large building at the intersection of East Sixth Street and Superior Avenue is the Federal Reserve Bank. Next door, to the left on the view above, on East Sixth Street, is the East Ohio Gas Company Building. The huge structure a few doors to the left of the Statler Hotel (5) is the Union Trust Building. The Brotherhood of Locomotive Engineers Building is the one with the U-shaped roof, shown to the right of the Annex.

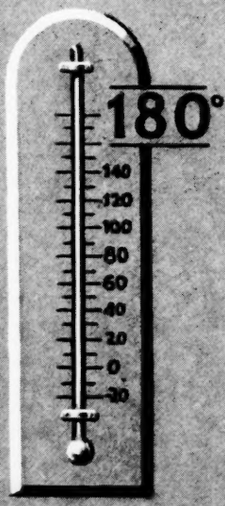
The site of Higbee's new air conditioned department store, now opened, is in the small triangle to the right of the Terminal Tower. Across Ontario Street, somewhat to the right, can be seen the May Company Department store, the name being painted on the roof.

William Taylor & Sons store is the large building immediately right of the words "Euclid Avenue."

CONDO-VAC

RETURN LINE VACUUM PUMP

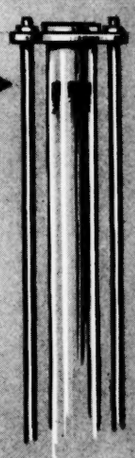




CONDO-VAC Will Return Water to the Boiler When Returns are in Excess of 200° F.

180°-F— 10" Vacuum

200°-F— Full Water Capacity



See the PROOF of these CLAIMS!

The CONDO-VAC Will Handle Hot Air and Hot Water at Booths 137 and 141 Heating and Ventilating Exposition, Cleveland, Ohio, January 25—29—1932.

CHICAGO PUMP COMPANY

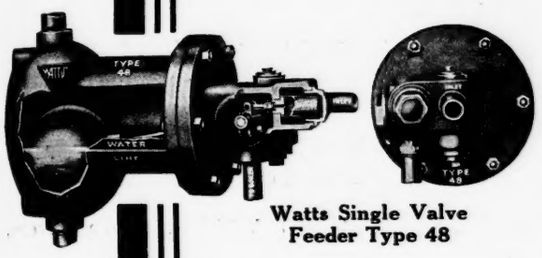
SEWAGE-CONDENSATION-CIRCULATING
BILGE-FIRE-HOUSE-VACUUM

2336 WOLFRAM STREET, CHICAGO — 79 MADISON AVENUE, NEW YORK

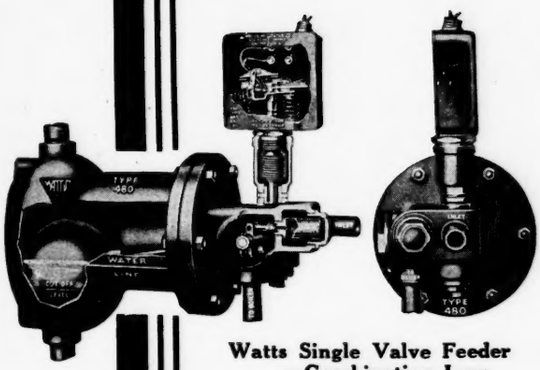
Representatives in All Principal Cities

Important New Exclusive Features Appeal to Buyers

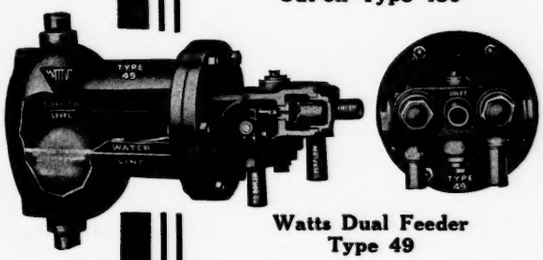
INTERCHANGEABILITY . . . ACCESSIBILITY . . . COMPACTNESS . . . ROTATING SHAFT . . . ADJUSTMENT FEATURE . . . NON-METALLIC DISC PROTECTED BY MONEL SPRING SHOCK ABSORBER



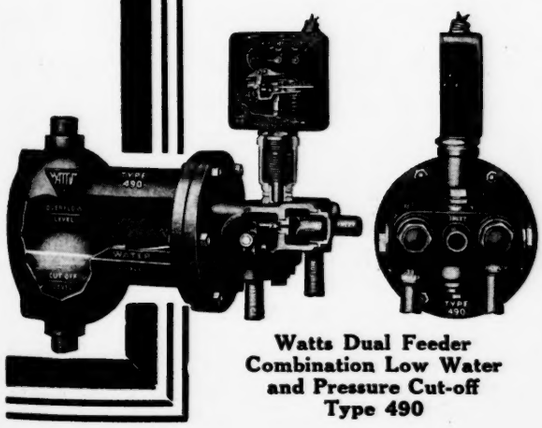
Watts Single Valve Feeder Type 48



Watts Single Valve Feeder —Combination Low Water and Pressure Cut-off Type 480



Watts Dual Feeder Type 49



Watts Dual Feeder Combination Low Water and Pressure Cut-off Type 490

WATTS

BOILER WATER FEEDERS

Now you can install a single valve Watts Boiler Water Feeder and convert it into a Dual Feeder if needed, or add a low water cut-off and pressure switch, without removing the Feeder from the line or changing the piping.

The float is connected by a float rod to a rotating shaft which operates the feed and overflow valves. There is no sliding friction to cause wear—no possibility of sticking.

The feed level can be easily changed even after the Feeder is installed.

The non-metallic disc in the feed valve assures tight and positive seating and it will not be injured by foreign matter.

A bronze strainer keeps dirt out of the system and is easy to clean.

Both single valve and dual feeders can be furnished with a switch which will shut down the burner or stoker when the steam pressure reaches a desired point, or should the water become dangerously low due to the failure of the water supply. Watts switches give dual protection.

In spite of the above and other features, Watts Feeders cost no more than ordinary makes.

An interesting Feeder booklet and our special proposition to contractors sent on request. Simply mail the coupon.

WATTS REGULATOR CO.

253 Lowell Street LAWRENCE, MASS.

John G. Kelly, Inc., Distributors
210 E. 45th St., New York, N. Y.

W. H. Cunningham & Hill, Ltd., Canadian Distributors
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Makers of Water and Steam Regulating Devices Since 1874

WATTS REGULATOR CO.
253 Lowell Street, Lawrence, Mass.

Without obligation, please send us a copy of your Feeder Booklet and your special proposition to contractors.

Name .....

Address .....

City .....State.....

Jobber's Name .....

ALPHABETICAL LIST

SECOND INTERNATIONAL HEATING

169 ADAMS BROS. MFG. CO., INC., Pittsburgh, Pa.
Space heaters and fireplace heaters. E. C. Adams, J. E. McKivergin and H. L. Bohon.

21 THE AIR CONTROL SYSTEMS, INC., Chicago, Ill.
Air systems, small units, for homes and offices. S. B. Paul, R. S. Kopp, A. G. Millican and W. D. Jordan.

1 AIR REDUCTION SALES CO., New York, N. Y.
A completely welded heating-piping installation; welding and cutting equipment. S. Fetter, F. J. Maeurer, J. F. Callahan, H. Henriques, L. H. Place, R. Metzger, R. Fisher and C. S. Peters.

125 ALCO VALVE CO., Maplewood, Mo.
Oil and gas valves.

42 AMERICAN AIR FILTER CO., INC., Louisville, Ky.
44 Dry and viscous air filters in automatic and manual types, and Airgard window ventilator. H. C. Murphy, J. R. McConnell, W. M. Reed, F. K. Minor, J. D. Reed, Carl Eyster, Wm. F. Shaw.

172 AMERICAN GAS ASSOCIATION, New York, N. Y.
Literature, charts, and books on house-heating and cooling with gas fuel. C. W. Berghorn and C. G. Segeler.

55 AMERICAN GAS ASSOCIATION TESTING LABOR-
57 ATORY, Cleveland, Ohio.
Display and lantern slides of Cleveland and Los Angeles laboratories; literature. F. R. Wright.

275 THE AMERICAN GAS PRODUCTS CORP., New
277 York, N. Y.
Gas boilers. W. V. Garrison, Jr., and H. B. Van Hook.

190 AMERICAN OIL BURNER ASSOCIATION, New York, N. Y.
Center for oil heating industry. C. A. Whitney.

438 THE AMERICAN PROPELLER CO., South Bend, Ind.
Ventilating equipment. M. H. Fairbank, W. A. Lee, C. M. MacVicar, D. L. Churchill and M. A. Smith, Jr.

338 AMERICAN RADIATOR CORPORATION, New York,
340 N. Y.
437
441
Boilers and radiators.

270 AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, New York, N. Y.
A. V. Hutchinson, P. D. Close and L. H. Korman.

102 AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, New York, N. Y.
A. H. Baer, D. L. Fiske, G. Muffly, A. W. Oakley, H. Harrison and H. H. Peffer.

369 AMERICAN TEMPERATURE INDICATING CO., Toledo, Ohio.
Temperature indicating equipment. Mr. Kuhlman.

348 AMES IRON WORKS, Oswego, N. Y.
Steel firebox heating boiler.

448 AMES PUMP CO., INC., New York, N. Y.
450 Vacuum and condensate pumps. C. F. Ames and W. E. Berrington.

140 ARMSTRONG MACHINE WORKS, Three Rivers, Mich.
Glass model of inverted bucket trap operating on 5 lb. steam pressure. A. E. Armstrong, T. H. Rea, O. E. Ulrich and M. H. Frank.

476 THE AUER REGISTER CO., Cleveland, Ohio.
Grilles for radiator enclosures, air conditioning, forced air intakes and registers, and metal access doors and panels. G. S. Auer, G. G. Auer, L. Komora and F. Janoushek.

1000 AUTOMATIC BURNER CORP., Chicago, Ill.
1001 Oil burners. J. Hirsch, W. H. Burdette and C. A. Rubowitz.

138 BARBER-COLMAN CO., Rockford, Ill.
Electrically-operated temperature control equipment. R. P. Dewey, C. J. Braatz, T. K. Greenlee, C. F. Hayden, H. C. Shilling, L. C. Plaehn and R. D. Richards.

170 THE BARBER GAS BURNER CO., Cleveland, Ohio.
Gas burners and gas pressure regulators. H. E. Kerr, I. E. Baker, H. M. Mansfield and R. O. Glascott.

135 BARNES & JONES, INC., Boston, Mass.
Heating system apparatus and specialties. C. W. Raab.

238 THE BISHOP & BABCOCK SALES CO., Cleveland, Ohio.
Streamline, squirrel cage, and propeller fans; unit heaters; temperature regulation and steam specialties. M. I. Levy, G. Brenkman, A. C. Duperow, W. Root, H. C. Goodwin and A. G. Getzendanner.

259 BOHN ALUMINUM & BRASS CORP., Capitol Brass Division, Detroit, Mich.
Temperature control valves; manual control valves. F. L. Hutchinson.

74 B-LINE BOILER CO., Cleveland, Ohio.
Gas-fired boilers. L. E. Bovee, G. B. Shaw, E. J. Wettrick, J. M. Wilson and R. E. Curtis.

ST OF EXHIBITORS

ING AND VENTILATING EXPOSITION

126 BONNEY FORGE & TOOL WORKS, Allentown, Pa.
128 Weldolets, Thredolets, and wrenches. F. S. Durham, G. F. Sherman and R. C. Sickler.

130 THE BORDEN CO., Warren, Ohio.
Pipe cutting and threading tools and machines. E. R. Barkley.

43 THE BROWNELL CO., Dayton, Ohio.
45 Boilers and stokers.

54 THE BRYANT HEATER & MFG. CO., Cleveland, Ohio.
Dualator and other gas heating equipment.

30 BUCKEYE BLOWER CO., Columbus, Ohio.
34 Unit ventilators.

229 BUILDING ARTS EXHIBIT, Cleveland, Ohio.

165 BURDETT MFG. CO., Chicago, Ill.

350 CARRIER ENGINEERING CORP., AEROFIN CORP.
352 CARRIER-LYLE CORP., BRUNSWICK-KROESCHELL CORP., and CARRIER-YORK CORP., Newark, N. J.
Air conditioning equipment, refrigeration equipment, unit heaters and atmospheric cabinets.

236 W. D. CASHIN CO., So. Boston, Mass.
Heating specialties.

23 CARBONDALE MACHINE CO., Carbondale, Pa.
Refrigerating machinery.

186 CENTURY ELECTRIC CO., St. Louis, Mo.
Motors and electric fans. E. S. Pillsbury, R. J. Russell, J. L. Woodress and C. O. Hedges.

95 CENTURY ENGINEERING CORP., Cedar Rapids,
97 Iowa.
Fuel oil burner. J. A. Lattner and M. D. McWilliams.

279 W. M. CHACE VALVE CO., Detroit, Mich.
Thermostatic bimetals. H. D. Matthews, J. A. Kienle, P. G. Chace and J. C. Schwab.

137 CHICAGO PUMP CO., Chicago, Ill.
141 Vacuum and condensation pumps and hot water circulating pumps. M. I. Weil, G. F. Mannion, G. A. Thom and T. E. Kroone.

170 CLEVELAND GAS BURNER & APPLIANCE CO., Cleveland, Ohio.
Gas burners and gas pressure regulators. H. E. Kerr, R. O. Glascott, I. E. Baker, L. W. Kruger, H. M. Mansfield and C. W. Stine.

288 CLEVELAND STEEL PRODUCTS CORP., Cleveland, Ohio.
Oil burners. E. J. Tubbs and W. H. Drew.

19 CLEVELAND STOKER CO., Cleveland, Ohio.
Domestic coal stoker. C. W. Hitchcock and L. Hitchcock.

25 COAL CARBURETOR CO., New Brunswick, N. J.
Coal carburetor combustion equipment. J. M. Price and C. H. Van Winkle.

63 COLUMBIA BURNER CO., Toledo, Ohio.

480 THE COLUMBUS HUMIDIFIER CO., Columbus, Ohio.
Humidifiers. F. D. Pfening, H. Pfening, P. Pfening and M. S. Conklin.

175 COOK ELECTRIC CO., Chicago, Ill.
Heat controls and automatic gas valves. G. R. Folds, W. W. True and D. W. Bergstrom.

225 COOLING AND AIR CONDITIONING CORP., New
227 York, N. Y.
Unit air conditioner. M. Hitchen, A. H. Clogston, J. McHollan, M. O'Connell and A. J. Lawless.

124 COPELAND PRODUCTS, INC., Mt. Clemens, Mich.
Cooling equipment.

142 COPPUS ENGINEERING CORP., Worcester, Mass.
Air filters, combustion control, manhole ventilators, steam turbines, heat killers. O. Wechsberg, M. Van Stappen, E. Kundig and R. B. Clapp.

4650 CRANE CO., Chicago, Ill.
147 Pipe fittings. S. Moore, C. S. O'Brien, H. S. Hornsby and J. E. Schutte.

99a CRYSTAL OIL BURNER CORP., New York, N. Y.
Oil burners. J. P. McCarthy and B. W. Mathes.

479 DAIL PRODUCTS CO., Lansing, Mich.
Air conditioning warm air furnaces.

46 DOHERTY-BREHM CO., Chicago, Ill.
Humidifiers.

354 C. A. DUNHAM CO., Chicago, Ill.
358 Average temperature control, concealed ra-
459 diators, unit heaters, etc. C. A. Thinn, W. W. Timmis, F. W. Wise, L. Nichols and D. J. Prentice.

75 DUNKIRK RADIATOR CORP., Dunkirk, N. Y.
Boilers and radiators.

492 EAGLE PICHER LEAD CO., Joplin, Mo.

66 THE EAST OHIO GAS CO., Cleveland, Ohio.
68 Office display. J. C. Shanks.

(Continued on Page 18)

GUIDE TO

Second International Heating

In addition to the gas-burning, oil-burning and warm-air heating sections, there are other groups of exhibits not definitely sectionalized, as follows:

COMBUSTION GROUP—
furnaces, burners (oil and gas), grates, stokers, boilers, radiators (various types), refractories and auxiliaries.

HYDRAULIC GROUP—
water feeders, water heaters, pumps, traps, valves, piping, fittings, expansion joints, pipe hangers, etc.

STEAM HEATING—
vapor heating and steam specialties.

AIR GROUP—
warm-air furnaces and stoves, registers and grills, cooling towers, air filters, motors, fans, blowers, conditioning equipment, ventilators (room and industrial types), unit heaters, etc.

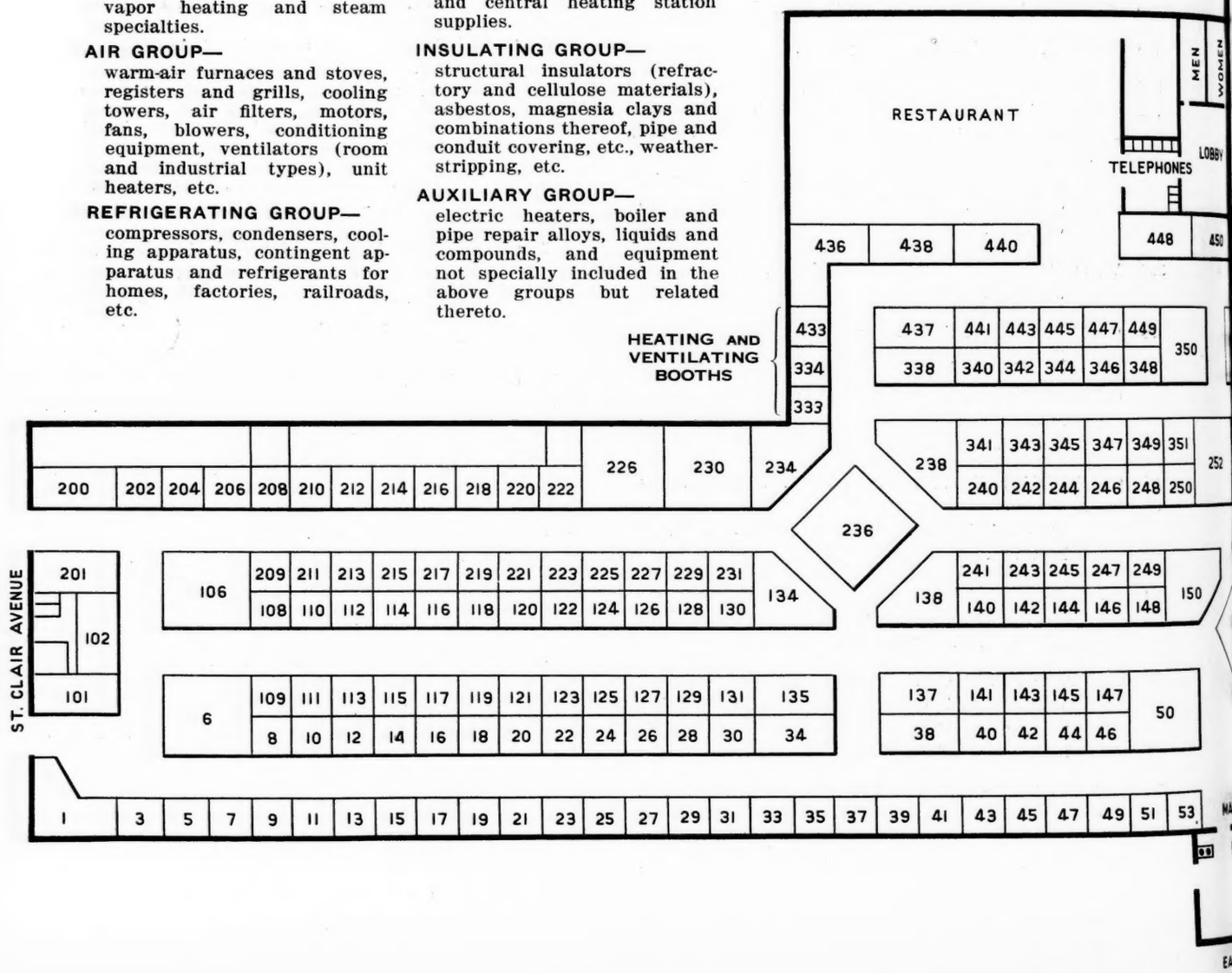
REFRIGERATING GROUP—
compressors, condensers, cooling apparatus, contingent apparatus and refrigerants for homes, factories, railroads, etc.

CONTROL GROUP—
instruments of precision for indicating, controlling or recording temperature, pressure, volume, time, flow, draft or any other function to be measured.

CENTRAL HEATING GROUP—
apparatus and materials especially designed or adapted to the uses of central heating, and central heating station supplies.

INSULATING GROUP—
structural insulators (refractory and cellulose materials), asbestos, magnesia clays and combinations thereof, pipe and conduit covering, etc., weather-stripping, etc.

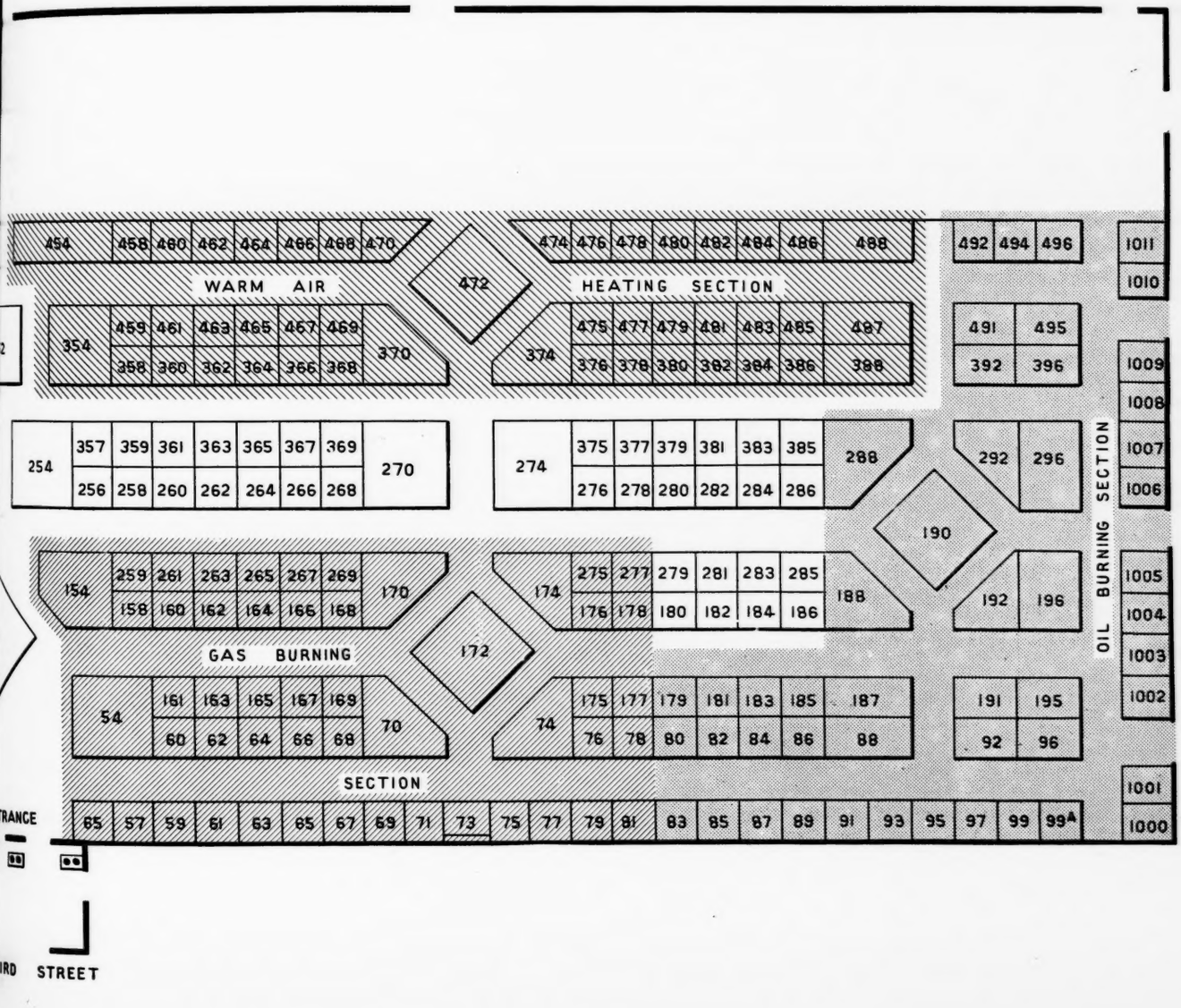
AUXILIARY GROUP—
electric heaters, boiler and pipe repair alloys, liquids and compounds, and equipment not specially included in the above groups but related thereto.



EXHIBITS

and Ventilating Exposition

Cleveland, Ohio . January 25-29, 1932 . Public Auditorium Annex . Held under the Auspices of the American Society of Heating and Ventilating Engineers . Managed by the International Exposition Co.



ALPHABETICAL LIST

(Continued from Page 15)

244 ECONOMY PUMPING MACHINERY CO., Chicago, Ill.
246 347 345 Centrifugal, sewage, and automatic sump pumps; centrifugal and vacuum heating pumps. R. H. Thomas, L. G. L. Thomas, H. R. Ryan and A. W. Kerr.

376 THE EMERSON ELECTRIC MFG. CO., St. Louis, Mo.
Unit heater and general line of motors, exhaust fans and furnace blowers. W. R. Fraser, T. J. Egan and R. L. Graves.

274 ENGINEERING PUBLICATIONS, Chicago, Ill.
Publications.

164 THE ESTATE STOVE CO., Hamilton, Ohio.
166 Heatrola for coal and gas. H. R. Stokes, A. H. Kohnen, M. D. Kahn, B. B. Kahn and L. L. Kahn.

366 FITZGIBBONS BOILER CO., New York, N. Y.
368 Steel boiler. R. Newcomb.

60 THE FOREST CITY FOUNDRIES CO., Cleveland,
62 Ohio.
Gas-fired warm-air furnace and air conditioning unit; warm-air coal furnace. W. J. Strangward, W. L. Seelbach, J. E. Seith and C. F. Seelbach.

174 THE FOX FURNACE CO., Elyria, Ohio.
Gas furnace and air conditioning system. C. A. Olsen, L. A. Selman and E. P. Hayes.

19 FOX SMITH SALES CO., Cleveland, Ohio.

204 FRICK CO., Waynesboro, Pa.
206 Refrigerating machinery. A. H. Baer, W. H. Aubrey, F. R. Zumbas, A. N. Chandler, and others.

212 FRIGIDAIRE CORP., Dayton, Ohio.
214 House cooling equipment.
216

187 FUEL OIL JOURNAL, New York, N. Y.
Publications. L. D. Becker, S. L. Calhoun, G. Kohl, W. J. Costigan and E. C. Shaw.

160 GENERAL GAS LIGHT CO., Kalamazoo, Mich.
162 Gas unit heaters and radiant heaters. G. A. Humphrey, L. F. Ryall, W. L. Powers and M. J. Grandbois.

1008 GILBERT & BARKER MFG. CO., Springfield, Mass.
1009 Oil burners. W. F. Scully and W. W. Townsend.

458 GREENE GAS CLEANER CO., Cleveland, Ohio.
460 Dry air filters for ventilating systems. O. V. Greene, and others.

236 GRINNELL CO., INC., Providence, R. I.
Triple XXX piping, unit heaters, unit heater and cooler, traps, heating specialties, bends and headers, moistening equipment, humidity controls, unit heater controls, pipe hangers, cast and malleable fittings. J. D. Pryor, R. Bontecou, A. W. Moulder, H. E. Branch, F. H. Morris, F. M. Daugherty, G. W. Day and T. Floro.

465 HART & COOLEY MFG. CO., Holland, Mich.
Air conditioning registers, a volume control ventilating register; warm-air registers; line of ornamental grilles and automatic heat control. G. F. Nightingale and J. H. Van Alsburg.

292 HART OIL BURNER CORP., Peoria, Ill.
Oil burners. H. C. Schimpff.

382 HEATING & PIPING CONTRACTORS NATIONAL
384 ASSOCIATION, New York, N. Y. Publications.

192 HEATING JOURNALS, INC., New York, N. Y.
Publications. P. E. Fansler, A. E. Coburn, A. G. Winkler and F. A. Clark.

433 HEATING & VENTILATING, New York, N. Y.
334 Publications. C. H. B. Hotchkiss, C. Strock,
333 C. W. Presdee, J. H. Hyde and G. G. Turner.

468 HENRY FURNACE & FOUNDRY CO., Cleveland,
470 Ohio.
Furnaces, fans, blowers, air filters, registers and grilles. E. S. Moncrief and H. S. Sharp.

465 WILLIAM HIGHTON & SONS, Division of Hart & Cooley Mfg. Co., Holland, Mich.

454 THE HERMAN NELSON CORP., Moline, Ill.
Unit ventilator, heating system, invisible radiator and unit heater. E. H. Beling and T. M. Carey.

365 E. VERNON HILL CO., and AEROLOGIST PUB-
367 LISHING CO., INC., Chicago, Ill.
Thermometers, gauges, dust counters, air test cases, psychrometers, anemometers and publications. P. J. Marschall, E. V. Hill, E. B. Stark and S. M. Kerr.

244 HOFFMAN SPECIALTY CO., Waterbury, Conn.
246 Heating equipment. C. V. Haynes.
345
347

177 HOTSTREAM HEATER CO., Cleveland, Ohio.
Water heaters and controls.

38 ILLINOIS ENGINEERING CO., Chicago, Ill.
Heating system specialties and zone control equipment. R. L. Gifford, D. C. Matchett, J. L. Ehretsman and H. W. Jarrett.

362 INDEPENDENT AIR FILTER CO., Chicago, Ill.
Air filters. J. L. Harpham and Q. G. Ewen.

482 INDEPENDENT REGISTER & MFG. CO., Cleveland, Ohio.
Registers, ventilators and grilles. E. C. Fox, B. A. Quick and B. N. Richardson.

27 IRON FIREMAN MFG. CO., Portland, Ore.
29 Automatic coal stokers, home and commercial models. Factory executives.

ST OF EXHIBITORS

440 JOHNS-MANVILLE CORP., New York, N. Y.
Insulating materials. N. B. Sherrill, Jr., J. H. Mackay, E. A. Rack and J. R. East.

361 JOHNSON SERVICE CO., Milwaukee, Wis.
363 Control equipment.

191 S. T. JOHNSON CO., Oakland, Cal.
Oil burners.

283 KEASBEY & MATTISON CO., Ambler, Pa.
285 Asbestos and magnesia products. G. P. Grossman.

231 JOHN G. KELLY, INC., New York, N. Y.
Boiler feeders, circulators, pressure systems, relief and reducing valves. H. C. Schmidt, J. G. Kelly, B. E. Haines, C. Smith and W. M. Dillon.

366 KEWANEE BOILER CO., INC., New York, N. Y.
368 Steel heating boilers. R. Newcomb.

443 KEWANEE BOILER CORP., Kewanee, Ill.
445 Steel boilers, water heater, water heating garbage burner and tank. Cleveland office force.

131 KIELEY & MUELLER, INC., New York, N. Y.
Valves, steam traps, and water feeders. C. B. Soechtig and C. W. Raab.

485 KLEENAIRE FILTER CO., Stevens Point, Wis.
Air filters for heating and air conditioning systems. H. W. Davis, and others.

486 KNOWLES MUSHROOM VENTILATOR CO., New York, N. Y.
Mushroom ventilators.

464 LAKESIDE CO., Hermansville, Mich.
Furnace blowers, filters, air washers, air conditioning equipment. H. E. Gray and B. Bernstrom.

148 LEEDS & NORTHRUP, Philadelphia, Pa.
Temperature measuring equipment. A. F. Moriarty, J. A. Dufault and H. Brewer.

51 LINDE AIR PRODUCTS CO., New York, N. Y.
53 Oxweld welding and cutting apparatus, oxygen, acetylene and union carbide. T. C. Fetherston, H. Dyar, R. W. Boggs and T. Schwartz.

26 McCORD RADIATOR & MFG. CO., Detroit, Mich.
28 Unit Heaters. C. W. Owston, M. Dunn and Mr. McGeorge.

161 J. H. McCORMICK CO., Philadelphia, Pa.
163 Gas boiler, cabinet units, window units, furnace unit. P. J. Foresman, L. L. Turney, E. T. Blaker and R. Clarkson.

154 JAS. P. MARSH & CO., Chicago, Ill.
Heating system specialties, automatic air valves, gauges, valves and vents. P. W. Beggs, T. Kenney and A. D. Rose.

182 McDONNELL & MILLER, Chicago, Ill.
Boiler safety feeders, water feed regulator, low water controls. E. N. McDonnell, B. Adams, W. A. Murphy, A. D. Porter, J. McDonnell and W. G. Boales.

462 MASONITE CORP., Chicago, Ill.
Structural insulation, quartboard and presdwood. R. T. Miller.

238 MASSACHUSETTS BLOWER CO., Cleveland, Ohio.
Fans, blowers, and unit heaters.

1002 MAY OIL BURNER CORP., Baltimore, Md.
1003 Oil burners.
1004

195 THE MERCOID CORP., Chicago, Ill.
Automatic controls. J. W. Owens, N. J. Allaben, H. A. Matthews, W. K. Stanffer and W. L. Colter John.

42 MIDWEST MFG. CO., Bradford, Pa.

280 MINERAL FELT INSULATING CO., Toledo, Ohio.

256 MINNEAPOLIS-HONEYWELL REGULATOR CO.,
258 Minneapolis, Minn.
260 Temperature controls for domestic, commercial and industrial uses. G. D. Kingsland, C. Delano, W. Griggs, and others.

184 THE MODERN HEAT REGULATOR CO., Cleveland, Ohio.
Heat regulators and thermostats. E. Kohl.

375 MODINE MFG. CO., Racine, Wis.
Unit heaters, copper radiation and coppercast radiation. A. G. Dixon and M. I. Kishler.

92 MONARCH MFG. WORKS, INC., Philadelphia, Pa.
Oil burner accessories, atomizing nozzle, strainers and valves. W. Czarnecki.

39 MOTORSTOKER CORP., New York, N. Y.
41 Bituminous and anthracite ash removing stokers, and domestic automatic coal burner.

88 THE MOTOR WHEEL CORP., Lansing, Mich.
Oil-burning weather control unit, oil-burning water heater and oil-burning boiler. C. L. Stebbins, R. E. Mulvogue, and others.

261 L. J. MUELLER FURNACE CO., Milwaukee, Wis.
263 Gas furnaces and boilers, and air conditioning units. H. P. Mueller, E. A. Jones and F. C. Dunning.

374 MULTICELL RADIATOR CORP., Lockport, N. Y.
Unit heaters, heating and cooling surface. H. F. Hutzel and G. W. Gerstung.

152 NASH ENGINEERING CO., South Norwalk, Conn.
Pumps.

ALPHABETICAL LIST

49 MOUAT VAPOR HEATING CO., Cleveland, Ohio.

261 L. J. MUELLER FURNACE CO., Milwaukee, Wis.
263 Furnaces and domestic air conditioning systems.

179 MUELLER BRASS CO., Port Huron, Mich.
181 Copper pipe and fittings, valves. J. R. Wightman.

374 MULTICELL RADIATOR CORP., Lockport, N. Y.
Unit heaters.

240 NATIONAL RADIATOR CORP., Johnstown, Pa.
242 Cast iron and steel boilers, radiators, con-
341 vectors, and condensing units. C. A. Sawade
343 and T. A. Movotney.

202 NIAGARA BLOWER CO., New York, N. Y.
Air conditoner, brine spray cooler; also several coils and desk fan machines.

472 NATIONAL WARM AIR HEATING ASSOCIATION, Columbus, Ohio.

364 NOCARE ELECTRIC RADIATOR CORP., New York, N. Y.
Electric steam radiators. H. G. Glass, H. Young, H. Sauer and N. C. Johnson.

223 OHIO ELECTRICAL & MFG. CO., Cleveland, Ohio.

190 OIL HEATING INSTITUTE, New York, N. Y.

475 OWENS-ILLINOIS GLASS CO., Toledo, Ohio.
Air filter. J. S. Irvine, G. Slayter, H. W. Collins and E. F. Chittenden.

53 OXWELD ACETYLENE CO., New York, N. Y.

357 PARKER APPLIANCE CO., Cleveland, Ohio.
359 Fittings, valves, tube benders and tube for copper piping. C. E. Klamm and W. F. Rapprich.

436 PARKS-CRAMER CO., Fitchburg, Mass.
Air conditioning apparatus. Mr. Karlson, Mr. Dorr, and others.

64 PATROL VALVE CO., Cleveland, Ohio.
Safety ignition system, pilot safety controls. W. A. Schule, B. L. Matthews, S. H. Nimmo and J. T. Marvin.

467 PEERLESS UNIT VENTILATION CO., Bridgeport,
469 Conn.
Unit ventilators.

87 PENN ELECTRIC SWITCH CO., Des Moines, Iowa.
89 Controls for heating and ventilating equipment. N. B. Delaven.

254 PENN HEAT CONTROL CO., Philadelphia, Pa.
Heat regulators. R. M. Peters.

168 PENNSYLVANIA FURNACE & IRON CO., Warren, Pa.
Gas Furnaces and floor heaters. A. L. Schellhammer, H. A. Stewart, R. L. Blodgett and J. D. Kroeker.

388 PETROLEUM HEAT & POWER CO., Stamford,
487 Conn.
Gas and oil burning boilers, oil burners, automatic gas heating unit and accessories. W. C. McTarnahan, C. E. Shields, H. W. Dexter and M. J. Hammers.

348 PIERCE, BUTLER & PIERCE MFG. CORP., New
348A York, N. Y.
449 Cast iron and steel boilers, radiators and
449A packless valves. P. J. Faherty, E. T. McCormack and J. C. Murphy.

241 PIQUA ELECTRIC MFG. CO., Piqua, Ohio.
243 Exhaust and ventilating fans, motors. M. W. Bauer.

282 PLUMBING & HEATING CONTRACTORS TRADE
284 JOURNAL, New York, N. Y.
286 Publications. E. J. Hudson and R. G. Bookhout.

342 THE POWERS REGULATOR CO., Chicago, Ill.
Temperature control. F. G. Bridges and Wm. P. MacFarland.

1006 PREFERRED UTILITIES MFG. CORP., New York.
Oil burner accessories. R. S. Bohn and G. P. Gregory.

234 PROPELLAIR, INC., Columbus, Ohio.
Propeller fans. C. V. Vibber, M. P. Ziegler and J. P. Novatny.

84 PERFECTION STOVE CO., Cleveland, Ohio.
86 Oil burners.

385 THE RAWLPLUG CO., INC., New York, N. Y.
Rawlplugs, rawldrills, crowners, lok-crowners and rawl-anchors. H. G. Janton.

265 F. I. RAYMOND CO., Chicago, Ill.
267 Duo-stats, syncro-flow heating systems. F. I.
269 Raymond.

461 RIC-WIL CO., Cleveland, Ohio.
463 Conduit.

176 ROBBINS & MEYERS GAS APPLIANCES, INC.,
178 Springfield, Ohio.
Gas burners. H. Burke and W. R. Jones.

370 RICHARDSON & BOYNTON CO., New York, N. Y.
Furnaces.

40 H. H. ROBERTSON CO., Pittsburgh, Pa.
Ventilators and other products. P. Blommers.

249 ROCHESTER CIRCULATOR SALES DIV.,
Rochester, N. Y.
Electric hot water circulators. F. M. Harm and B. F. Bart.

67 ROUND OAK FURNACE CO., Dowagiac, Mich.
69 Gas and coal-fired furnaces. F. S. Cole, E. S. Burch, J. F. Nugent, W. W. Kelso and H. L. Draper.

IST OF EXHIBITORS

447 W. A. RUSSELL & CO., New York, N. Y.
Air and vacuum valves, and compound gauges. H. W. Reis.

158 RUUD MFG. CO., Pittsburgh, Pa.
Automatic gas water heaters. M. M. Scott, R. H. Lewis and A. P. Brill.

118 SAFETY EQUIPMENT SERVICE CO., Cleveland,
120 Ohio.
Accident prevention and safety equipment, first aid supplies. B. W. Butt and W. R. Paterson.

150 SARCO CO., INC., New York, N. Y.
Heating system specialties. E. J. Ritchie.

276 H. M. SHEER CO., Quincy, Ill.
278 Heat regulators, motor gas valves, thermostats, limit controls, safety pilots and humidifiers. J. R. Williams, R. T. Williams and G. H. Williams.

83 SILENT GLOW OIL BURNER CO., Hartford, Conn.
85 Oil burners. C. M. Merrick and R. H. Syner.

188 TIMKEN SILENT AUTOMATIC CORP., Detroit, Mich.
Oil burners, water heaters and humidifiers. F. Glover, H. Finnie, W. C. Wood, L. R. Baldack, E. V. Walsh, M. B. Ells, R. Hooke, T. A. Crawford, H. M. Soyster, M. Powers and F. M. Jordan.

59 THE SILICA GEL CORP., Baltimore, Md.
61 Domestic dehumidifying unit. E. B. Miller, J. C. Patterson and B. F. Fonde.

121 SKIDMORE CORP., St. Joseph, Mich.
123 Vacuum and condensation pumps. B. Skidmore and V. D. Milliken.

35 SPENCER HEATER CO., Williamsport, Pa.
37 Boilers. F. W. Earnest, Jr., and J. A. Waddell.

49 STAY-RITE CORP., Cleveland, Ohio.

248 STRUTHERS DUNN, INC., Philadelphia, Pa.
250 Controls, relays and electric melting pots and ladles. J. S. Dunn, G. Morris and N. McKinney.

47 SUN RADIATOR COVER, INC., Cleveland, Ohio.
Radiator enclosures and shields. J. E. Speer and C. E. Klienschnitz.

70 SURFACE COMBUSION CORP., Toledo, Ohio.
Gas-fired furnace, conversion burner, blower, unit heaters, garage heater. C. B. Phillips, E. A. Weaver, N. B. Buehrer, N. T. Branch and G. P. Mandel.

33 THE SWARTOUT CO., Cleveland, Ohio.
Rotary ventilators. L. P. Russon.

143 TACO HEATERS, INC., New York, N. Y.
145 Water heaters. R. L. Blanding.

127 WEBSTER TALLMADGE CO., New York, N. Y.
Heating system.

268 H. O. TRERICE CO., Detroit, Mich.
Traps, thermometers, recording-dial indicating instruments. H. F. Williams.

486 TUTTLE & BAILEY MFG. CO., New York, N. Y.
Grilles, registers and ventilators. T. A. Warner, and E. Mollander.

477 UNI-FLO GRILLE PRODUCTS CO., Detroit, Mich.
Grilles and registers. J. A. Germonprez and J. D. Searles.

51 UNION CARBIDE CO., New York, N. Y.

485 U. S. HAME CO., Buffalo, N. Y.
Pipe wrenches and hammers. T. W. Porter and R. H. Walker.

129 J. H. H. VOSS, INC., New York, N. Y.

386 WAGNER ELECTRIC CO., St. Louis, Mo.
Motors and blowers. E. A. Forkner, J. A. Grant, R. L. Matthews and P. Baker.

360 THE WARM AIR FURNACE FAN CO., Cleveland, Ohio.
Furnace fans and blowers. L. M. Uhl, J. Polshek and J. C. Miles.

252 WARREN WEBSTER & CO., Camden, N. J.
Heating systems, heating system controls. H. F. Marshall.

474 WARM AIR HEATING, St. Louis, Mo.
Publications. P. L. Reed, R. F. Farnham, E. Sinnock and F. R. Jones.

262 WEIL-McLAIN CO., Chicago, Ill.
264 Boilers and radiators. T. D. Casserly, R.
266 Lawrence and W. T. Coltrin.

134 W. P. WHITTINGTON, INC., Indianapolis, Ind.
Vacuum heating pump. W. P. Whittington.

466 L. J. WING MFG. CO., New York, N. Y.
Unit heaters, ventilating fans and exhausters, steam turbine and motor-driven blowers. W. Myers, A. E. Seelig, H. S. Wheller and A. C. Danks.

231 WATTS REGULATOR CO., Lawrence, Mass.
H. C. Schmidt, J. C. Kelly, B. E. Harne, W. Dillon and C. Smith.

226 YORK ICE MACHINERY CORP., York, Pa.
Refrigerating equipment.

167 YOUNG RADIATOR CO., Racine, Wis.
Unit heaters, cabinet and concealed radiation. F. M. Young, W. H. Schleck and J. J. Hilt.

344 THE YOUNGSTOWN SHEET & TUBE CO., Youngs-
346 town, Ohio.
Working model of tube-mill. M. S. Curtis, R. D. MacKenzie and W. S. Badger.

91 YORK OIL BURNER CO., York, Pa.
93 Oil burners.

•PROGRAM•

American Society of Heating and Ventilating Engineers

THIRTY-EIGHTH ANNUAL MEETING
JANUARY 25-29, 1932, HOTEL STATLER, CLEVELAND, OHIO

MONDAY—JANUARY 25

10:00 a.m.—Meeting of the Council.

12:30 p.m.—Luncheon for Officers and Authors.

2:00 p.m.—Meeting Committee on Research.

7:00 p.m.—Joint Dinner-Meeting of the Councils of the A.S.H.V.E. and A.S.R.E. and their wives (Hotel Cleveland).

8:30 p.m.—Inspection of Second Heating and Ventilating Exposition.

TUESDAY—JANUARY 26

9:30 a.m.—First Session (Ballroom, Hotel Statler).

Address of Welcome.

Response by President W. H. Carrier.

Reports of Officers.

Report of Council.

Reports of Council Committees (Executive, Finance, Membership and Publication).

Report of Committee on Research.

Report of Director of Research Laboratory, F. C. Houghten.

Reports of Technical Advisory Committees.
Reports of Special Committees (*Guide* Publication and Membership Increase).

Reports of Continuing and Cooperating Committees.

Report of Tellers of Election.

Technical Papers—
Surface Coefficients as Affected by Direction of Wind, F. B. Rowley and W. A. Eckley.

Conductivity of Concrete, F. C. Houghten and Carl Gutberlet.

2:00 p.m.—Second Session (Hotel Statler).
Technical Papers—
Importance of Radiation in Heat Transfer Through Air Spaces, E. R. Queer.

Heat Emission from Iron and Copper Pipe, F. C. Houghten and Carl Gutberlet.

Hot Water Friction Heads in One-Inch Cast Iron Tees, F. E. Giesecke and W. H. Badgett.

Some Fundamental Considerations of Corrosion in Steam and Condensate Lines, R. E. Hall and A. R. Mumford.

7:00 p.m.—Inspection of Second Heating and Ventilating Exposition.

8:30 p.m.—Informal Reception including entertainment and Monte Carlo (Ballroom, Hotel Statler).

WEDNESDAY—JANUARY 27

10:00 a.m.—Third Session (Cleveland Auditorium).
Joint Meeting with A.S.R.E.—Program arranged by A.S.H.V.E.

Technical Papers—
Changes in Ionic Content of Air in Occupied Rooms Ventilated by Natural and by Mechanical Means, C. P. Yaglou, L. C. Benjamin and S. P. Choate.

Acoustical Problems in Heating and Ventilating of Buildings, V. O. Knudsen.

Heat Transmission as Influenced by Heat Capacity and Solar Radiation, F. C. Houghten, J. L. Blackshaw and E. M. Pugh.

Field Studies of Office Building Cooling, S. S. Sanford, E. P. Wells and J. H. Walker.

2:00 p.m.—Trip to *Akron* (Goodyear-Zeppelin Hangar).

7:00 p.m.—Dinner for Past-Presidents and Wives (Hotel Statler).

8:00 p.m.—Ladies' Theater Party at Keith's Palace.

8:00 p.m.—Inspection of Second Heating and Ventilating Exposition.

THURSDAY—JANUARY 28

10:00 a.m.—Fourth Session (Cleveland Auditorium).
Joint Session with A.S.R.E.—See A.S.R.E. Program, page 24.

2:00 p.m.—Fifth Session.
Report of Committee on Testing and Rating Unit Ventilators.

Report of Committee on Ventilation Standards.

2:30 p.m.—Ladies' Bridge (Chamber of Commerce).

7:00 p.m.—Annual Banquet and Dance (Hotel Statler).

FRIDAY—JANUARY 29

10:00 a.m.—Sixth Session (Hotel Statler).
Technical Papers—
A Study of Intermittent Operation of Oil Burners, L. E. Seeley.

Room Warming by Radiation, A. H. Barker.

A Study of the Combustible Nature of Solid Fuels, R. V. Frost.

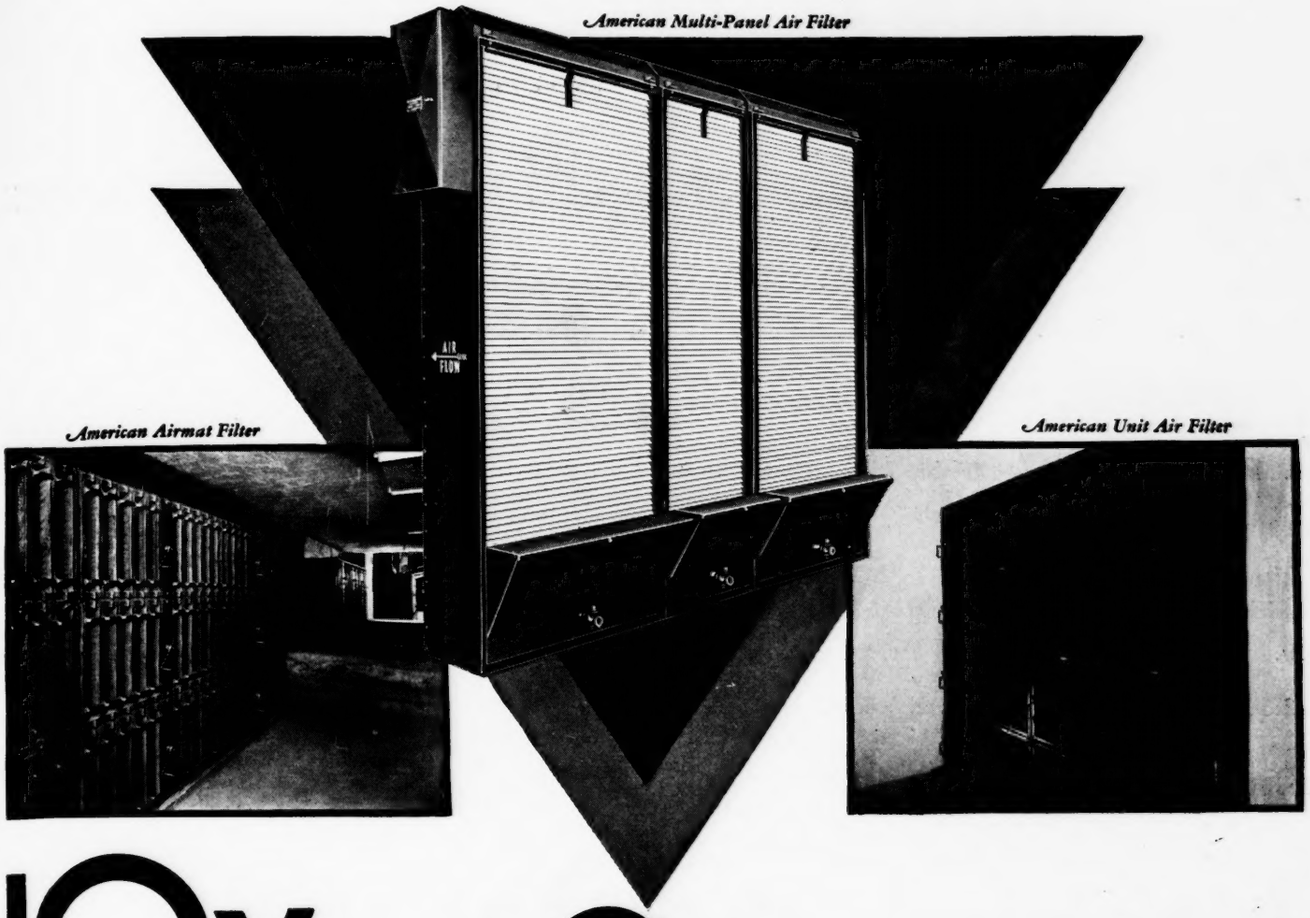
Installation of Officers.

Resolutions.

Adjournment.

12:30 p.m.—Luncheon and Meeting of Council.

2:00 p.m.—Inspection Trip to Cleveland Industrial Plants.



10 YEARS OLD... *and still the* STANDARD OF COMPARISON

Air filtration, which has made building ventilation and air conditioning practical under present day dust concentrations, was developed and pioneered by the engineers of the American Air Filter Company. Today you will find the newest and most advanced practices in modern air cleaning in our display at the International Heating and Ventilating Exposition.

The American Air Filter Company manufactures a complete line of air filtering equipment for use wherever clean, pure air is essential to Profit, Production and Health.

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AMERICAN AIR FILTER COMPANY, *Inc.*
118 Central Avenue, Louisville, Kentucky
In Canada, MIDWEST CANADA LTD., Montreal, P. Q.

AMERICAN AIR FILTERS

•PROGRAM•

American Society of Refrigerating Engineers

TWENTY-SEVENTH ANNUAL MEETING

JANUARY 25-28, 1932, HOTEL CLEVELAND, CLEVELAND, OHIO

MONDAY—JANUARY 25

7:00 p.m.—Joint Dinner—Meeting of the Councils of the A.S.R.E. and A.S.H.V.E. and their wives (Hotel Cleveland).

TUESDAY—JANUARY 26

10:00 a.m.—Registration opens, mezzanine floor.

12:30 p.m.—Welcome Lunch. Ball Room.
Remarks by President Baer and D. F. Keith.

2:30 p.m.—First Session (Ballroom, Hotel Cleveland).
Technical Papers—

Properties and Use of Metal Foil Insulation, J. L. Gregg.

Review of Refrigeration and Food Practices in Europe, Dr. Arthur W. Ewell.

Refrigerator Car Surface Temperature, W. J. Hukill.

The Refrigerating Machine as a Production Problem, Edward Hughes.

7:30 p.m.—Second Session (Hotel Cleveland).
Student Prize Session.

Technical Papers—

Relation Between the Colleges and Technical Societies, Wm. E. Wickenden.

Horsepower per Ton of Refrigeration on Small Ammonia Compressor, Henry F. Irving.

The Vapor Pressure of Ammonia Above Solutions of Ammonium Thiocyanate, Lewis H. D. Fraser, Jr.

Properties of Steam and Air Mixtures Below the Ice Point, Charles R. Lucas.

(Other student papers to be announced)

Entertainment—Ladies' parlor is attached to suite of Mr. and Mrs. Baer and Mr. and Mrs. Muffly on Parlor floor, one flight above mezzanine. Tea served at 4:30 p.m.

Hospitality headquarters for men during entire convention on ninth floor, room 9030.

9:00 p.m.—Hotel Statler.
Informal Reception including entertainment and Monte Carlo (Ballroom, Hotel Statler).

WEDNESDAY—JANUARY 27

10:00 a.m.—Third Session (Cleveland Auditorium).
Joint session with A.S.H.V.E. (See A.S.H.V.E. Program, page 22). Program arranged by the American Society of Heating and Ventilating Engineers.

2:00 p.m.—Fourth Session (Hotel Cleveland).
Technical Papers—

Use of Gas in Heating and Cooling of Homes, E. D. Milener.

Survey of Ice for Air Cooling Applications, R. T. Brizzolara.

Afternoon

2:00 p.m.—Buses leave hotel for trip to *Akron* (Goodyear Zeppelin hangar) with A.S.H.V.E.

Evening—Ballroom, Hotel Cleveland.

7:00 p.m.—Annual A.S.R.E. Jamboree. Formal dress optional, seat reservations until 4:00 p.m. Wednesday. Banquet, entertainment and dance.

THURSDAY—JANUARY 28

10:00 a.m.—Fifth Session (Cleveland Auditorium).
Joint session with the American Society of Heating and Ventilating Engineers. Program arranged by Program Committee, A.S.R.E.

Technical Papers—

Application of Electric Refrigeration to Heating and Cooling of Homes, A. R. Stevenson, Jr., F. H. Faust and E. W. Roessler.

Biological Aspects of Thermal Engineering, Dr. S. C. Prescott.

Air Conditioning as Applied to Cold Storage and a New Psychrometric Chart, Claude A. Bulkley.

2:00 p.m.—Sixth Session—Ballroom, Hotel Cleveland.
Technical Papers—

Two-Speed Synchronous Motors; Characteristics and Application, R. C. Allen.

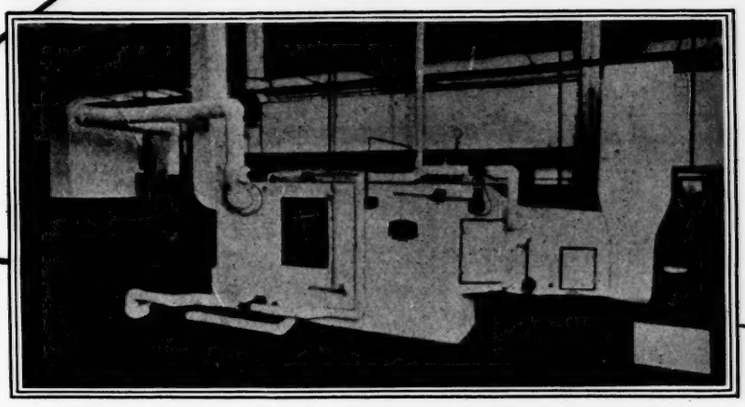
Natural Gas in the Refrigerating Plant, F. W. Laverty.

Oil Engine Compression Costs, C. R. Neeson.

(Formal adjournment)

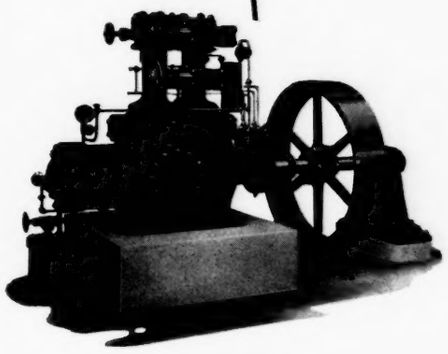
2:00 p.m.—Ladies' Bridge (with A.S.H.V.E.)
8:00 p.m.—Theater party for ladies.

GOLDEN ANNIVERSARY
1882 FRICK 1932
REFRIGERATING MACHINERY

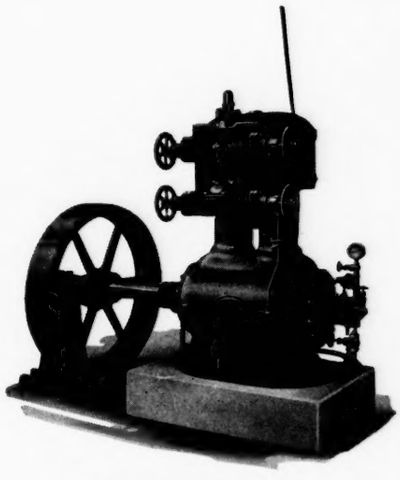


Installation at Servel, Inc., showing Frick machine attached to air conditioning apparatus

FRICK REFRIGERATION



CO_2 Compressor



Ammo. Compressor

For the vital part played by Refrigeration in the growing field of Air Conditioning, only the most dependable equipment can be considered. Whether ammonia or carbon dioxide machines are specified, they must be reliable and efficient.

These things have been the guide-posts followed by Frick Engineers and Mechanics in the building of both ammonia and carbonic Refrigerating equipment and there is a full line of types and sizes to suit all requirements —compressors, condensers and coolers. Valves and fittings always stocked.

Also, your inquiries receive the attention of a trained staff of sales engineers stationed in all principal cities. These men will give cheerful assistance on any problems entrusted to them.

See Frick Refrigeration at Booths 204 and 206, Heating and Ventilating Exposition

Frick Company
WAYNESBORO, PA. U.S.A.
ICE MACHINERY SUPERIOR SINCE 1882

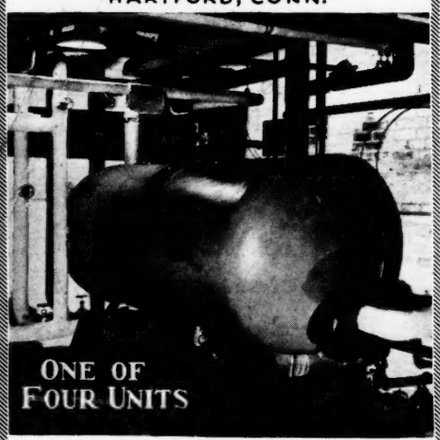
YEARS of—

In the application of heat and the recovery of waste heat...

THE LOS ANGELES GENERAL COUNTY HOSPITAL, LOS ANGELES

USES 12 WHITLOCK TYPE K HEATERS

THE AETNA LIFE INSURANCE CO. HARTFORD, CONN.



USES WHITLOCK TYPE K HEATERS WITH COPPER SHELLS BY BADGER

The two years since the last Exposition have been marked by new applications of Whitlock Heaters and the development of several new types.

Reducing fuel consumption 25 to 35 per cent by recovering heat from waste hot water.

Whitlock Preheater installations have almost doubled in number during the past two years. They are being used in textile mills and other industries -- as well as in hundreds of the larger laundries.

The keystone of economy -- uniform boiler load -- has been secured in many plants, using large quantities of hot process-water, by the Whitlock Unatherm System of Water Heating.

Textile mills, dyeing, bleaching and finishing plants, laundries and other industries are now using this system -- insuring a uniform rate of steam consumption and absolute control of the water temperature.

THE WHITLOCK COIL

PROGRESS

Clear, pure water, free from rust, is insured by three developments of the Whitlock Type K Service and Process Water Heaters. Whitlock Copper Shell Heaters (with shells by Badger), the Whitlock-Eterno Heater (with copper lined steel shells) and the Whitlock-Everdur Heaters (with shells of Everdur Metal) have been installed in many of the finest buildings.

And several developments in the design and construction of the standard Whitlock Type K Heater, have kept it in the lead.

The accompanying illustrations show a few of the hundreds of outstanding recent installations of Whitlock Heaters and Heat Exchangers.

These and other new types and applications of heaters and coolers are described in the 1931-32 series of Whitlock Bulletins, which will be sent on request.

For information or engineering service on Whitlock Products consult the nearest Whitlock District Office or authorized representative, in New York, Boston, Philadelphia, Chicago, Detroit, Kansas City, Baltimore, Charlotte, Los Angeles, San Francisco, and other principal cities.
Look under our name in your local telephone directory, or drop a line to us at Hartford.
In Canada Whitlock Heaters, Preheaters and Heat Exchangers are manufactured by Darling Bros., Ltd., 120 Prince St., Montreal.

THE WHITLOCK COIL PIPE CO.
40 South Street ∴ ∴ Hartford, Conn.

THE LAKE CITY LAUNDRY
CHICAGO

USES THE WHITLOCK PREHEATER for RECOVERING HEAT FROM THE WASTE HOT WATER

THE BERKSHIRE KNITTING MILLS
READING, PA.

USES THE WHITLOCK UNATHERM SYSTEM with WHITLOCK CLOSED TYPE PREHEATERS

PIPE COMPANY

The Heating and Venti

FOR the third successive year, HEATING AND VENTILATING presents a forecast of the probable distribution and value of heating, ventilating and air conditioning projects. Also, for the third successive year, the task of predicting the volume of building is a difficult one, due to the continued disturbed economic conditions.

There are discouraging signs pointing toward another poor year for building. There are also some encouraging factors to be taken into consideration in estimating what the year will bring. For example, included among the unfavorable features of the present outlook we find that:

(1) Business in general has shown no sign of a permanent turn for the better.
(2) It is undeniably true that some classes of buildings are overbuilt.
(3) No relief measures are in sight for mortgagees unable to carry their obligations.
(4) The industrial outlook and the financial condition of many industrial and utility companies precludes the possibility of a large amount of industrial building.
(5) A sharp increase in taxes is probable.

Some of the more encouraging signs pointing toward an increase in building for 1932 include:

(1) President Hoover's home loan proposal, designed to revive and stimulate residential building on a large scale.
(2) Construction stages will be reached on many public building projects, Federal, State and local.
(3) The low prices prevailing for building material and land.
(4) A possibility that if business does turn upward, an important percentage of the 30 billion dollars now tied up in savings deposits will be turned into the building field.

These are some of the factors which must be weighed and balanced in arriving at an estimate of building in 1932. In general, printed opinions are found to be rather optimistic. On the other hand, more pessimism is expressed verbally by those who are closely acquainted with the situation.

Before proceeding, let us examine a few of the factors mentioned above, both encouraging and discouraging.

Business in General

As stated above, there are at this writing no definite indications that business has as yet reached the bottom. Freight car loadings, steel mill production, and other more or less reliable indexes of business activity are reaching new lows almost every week, with only occasional small upturns which are wiped out the following week. (A slightly favorable sign is that some indexes are falling at a decreasing rate.) Awards for new building contracts reached 42.1 in November, as compared with 64.6 for the same month in 1930, and 106.5 as the index for the same month in 1929.

The business activity index of *The New York Times*, which reflects as accurately as a general index can, the state of business from week to week, was 63.7 for the week of December 19, 100 being the estimated normal. This index is based on car loadings, steel mill activity, electric power production, automobile production and cotton cloth production. Its progress during 1931 illustrates the statement made above that some indexes are declining at a decreasing rate. The index early in January, 1931, was 77.0, while by September 12 it had dropped to 70. On November 21 it reached 63.2, and since that time has fluctuated between 63 and 64.

It must be admitted that little hope can be held for increased building until there is a definite upturn in business in general.

Over-Building

A study of building permits for 215 cities shows that there undoubtedly was an abnormally high building

Table 1—Distribution of buildin

	Total	New England	Metrop. N. Y.	Upstate N. Y.	Middle Atlantic	Pittsburgh
Commercial	$298,000,000	$27,000,000	$100,000,000	$10,400,000	$31,300,000	$31,200,00
Industrial	104,000,000	5,600,000	9,300,000	2,800,000	11,100,000	15,000,00
Educational	297,000,000	47,000,000	59,000,000	17,200,000	32,000,000	32,000,00
Hospitals and Institutions	94,800,000	14,600,000	19,500,000	9,500,000	9,600,000	9,600,00
Public Buildings	217,500,000	19,000,000	37,200,000	12,300,000	55,200,000	21,400,00
Religious and Memorial	47,900,000	4,400,000	13,800,000	1,500,000	9,100,000	4,500,00
Social and Recreational	74,600,000	12,600,000	21,000,000	4,200,000	8,400,000	8,300,00
One- and Two-Family Houses	515,000,000	16,000,000	158,200,000	5,700,000	76,800,000	62,400,00
Apartments and Hotels	405,000,000	57,200,000	210,000,000	19,800,000	42,100,000	8,600,00
Total	$2,053,800,000	$203,400,000	$628,000,000	$83,400,000	$275,600,000	$193,000,00

...ating Forecast for 1932

boom from 1922 to 1929, higher than what would be justified on the basis of growth of population, shifts in population, and the relative increase in the number of families.

Reports by such organizations as the National Association of Building Owners and Managers concerning vacancies in existing buildings bear out this idea.

On the other hand, there is probably no overbuilding of residential buildings, taking the country as a whole. One real estate expert estimates that the accumulated deficit in American home building in 1931 was $1,228,000,000, $459,000,000 being the deficit built up in 1931. Allowing for a considerable discounting of this figure, it is still probable that there is an enormous potential building market awaiting only an upturn in business to be made available.

Relief for Mortgage Owners

One of the criticisms of President Hoover's Home Loan idea was that while it would encourage new building, it would do nothing to aid those who already are burdened with mortgages. This criticism will undoubtedly be given considerable prominence in the discussion of the President's proposal when it comes up before the Congress now in session.

Financial Condition of Industry

With production comparisons showing a minus sign in almost every conceivable industry, it is not surprising to find a resulting sharp reduction and even passing of dividends by leading industrial concerns. A good example is in the case of railroads, two of which passed their dividend recently for the first time in half a century.

The plight of industry is shown by the records of stock and bond prices. In December, 1931, railroad stocks dropped to the lowest prices since 1893. The comparison above shows the prices of various securities late in December and the average of the same issues during their high for the same year.

	December, 1931	*Peak, 1931*
40 Corporate bonds	73.36	96.76
10 High grade rails	79.77	98.94
10 Second grade rails	59.26	99.69
10 Public utilities	86.11	98.24
10 Industrials	68.16	94.17

While it may be claimed that a large portion of the spectacular drop is due to panic, nevertheless, the abnormal drop in earnings of the industrial companies, utilities, etc., is accountable for the present bond and stock prices to a considerable extent.

It seems logical to assume that even with a pick-up in business for 1932, such companies will spend but little for new buildings, as their first thought will necessarily be to provide for their clamoring stockholders.

Tax Increases

The large increases in Federal and State debts must be passed on to the tax-paying public in some form or another. Secretary Mellon's recent proposal for a formidable increase in income and luxury taxes met with considerable public disapproval. It seems probable that real estate and buildings will have to carry an increased burden. On the other hand, a plea for a reduction in property tax was called for by the President's Conference on Home Building. Just what the outcome will be is difficult to say. It seems optimistic to suppose that property can look for a decrease in taxes under present conditions.

The Home Loan Proposal

President Hoover disclosed on November 14 his plan for a nation-wide home loan system, planned to create some two billion dollars additional credit for home owners and builders. This project calls for the establishment of twelve discount banks, each of which would be authorized to issue bonds for short term notes to be secured by the obligations of the borrowers at the discount banks. The resulting reservoir of credit would

...ilding as forecast for 1932

Southeastern	Chicago	Central N.W.	So. Michigan	St. Louis	Kansas City	New Orleans	Texas
$10,400,000	$27,100,000	$4,200,000	$12,500,000	$8,400,000	$18,800,000	$4,200,000	$12,500,000
5,600,000	26,000,000	1,900,000	3,700,000	3,700,000	9,200,000	2,800,000	7,300,000
9,900,000	44,800,000	3,700,000	23,300,000	7,500,000	7,500,000	7,500,000	5,600,000
7,100,000	7,100,000	900,000	2,100,000	2,100,000	4,600,000	4,700,000	3,400,000
7,600,000	14,700,000	3,300,000	7,700,000	10,100,000	11,400,000	8,800,000	8,800,000
2,200,000	4,500,000	1,300,000	1,100,000	2,200,000	1,100,000	1,100,000	1,100,000
2,200,000	6,400,000	1,000,000	2,100,000	2,100,000	3,100,000	1,000,000	2,200,000
25,800,000	57,600,000	11,300,000	24,200,000	19,200,000	20,600,000	7,300,000	29,900,000
4,000,000	33,600,000	2,000,000	3,200,000	5,300,000	10,600,000	2,000,000	6,600,000
$74,800,000	$221,800,000	$29,600,000	$79,900,000	$60,600,000	$86,900,000	$39,400,000	$77,400,000

be used to stimulate residential building, relieving the strain on banks and loan associations, and providing work for the unemployed.

The plan in itself has met with popular approval and some technical disapproval. It must be kept in mind that regardless of how feasible the plan may sound, the idea has yet to undergo a baptism of criticism during its passage through Congress.

In considering the effect of this proposal on building in 1932, we have no means of knowing how long it will be, even if the plan were passed, before the credit is available.

Public Buildings

According to a recent report, Federal public building projects totaling $300,000,000 are now under contract, and half this much in addition has been authorized. This does not include buildings being erected by municipalities, counties and States. There is every indication that the present high rate of public building will continue during 1932. It is not clear whether the total dollar value contracted for will be greater than during 1931.

Building Material Costs

Building material prices and land costs are undoubtedly at the lowest point in years. The following table from the Monthly Labor Review of the Department of Labor shows comparative index numbers of costs, 1926 being equal to 100.

	1931	*1930*
Lumber	65.5	80.8
Brick	79.8	82.3
Cements	75.8	91.7
Structural steel	81.7	81.7
Paint	64.9	78.1
Others	89.0	98.0
All building materials	74.9	86.4

Expressed in another way, the dollar of 1926 purchase $1.16 worth of building materials in 1930, and $1.33 worth in September, 1931.

With wages in the building trades, however, it is another story. According to the United States Department of Labor, the average hourly wage rate of the building trades for September, 1931 was $1.428, as compared with $1.410 in 1930, a slight increase.

So far as wage scales are concerned, however, the encouraging feature is that it is doubtful if the present high wages will be continued. For example, the present building trades' wage scale in New York City expires April 30, 1932, and wage adjustments are expected. This may result in lower construction costs for which builders have been waiting.

Savings Banks Deposits

Savings banks deposits and building and loan assets are at record highs. Total savings banks deposits for the year 1930, for the entire United States, reached the total of $28,538,533,000. In New York State alone, for the year ending June 30, 1931, savings banks deposits increased $594,227,300, a rise of 13%. On July 1, 1931, the total due depositors was $5,160,391,903—by all means an all-time record.

In 1930, the total assets of savings and building and loan associations reached the imposing total of $8,828-611,926—a gain of nearly $129,000,000. During the same period, total membership increased 225,545.

If, in the light of these somewhat overwhelming figures, it is borne in mind that in real estate investment circles there is an increasing appreciation of the fact that fluctuations in value must be brought about as quickly as they are in other security markets, it becomes increasingly evident that this money will flow into building, and that heating and ventilating will receive its share.

In fact, so serious a problem does this gigantic savings sum present, that as recently as August 25, 1931, an eminent New York banker stated that "Land prices have not been so low in many years, and mortgage money for building can be had on very reasonable terms."

The Forecast

The forecast, as presented on these pages, does not include alterations or remodeling. That this part of the building program is of considerable importance is realized when one notes that in September, 1931, alterations and repairs accounted for over $14,000,000, almost half as much as the volume of new residential building, and almost 20% of the total of all building volume.

Table 2—Distribution of value of heating, ventilating

	Total	New England	Metrop. N. Y.	Upstate N. Y.	Middle Atlantic	Pittsburgh
Commercial	$23,485,000	$2,300,000	$8,000,000	$900,000	$2,500,000	$2,500,000
Industrial	4,941,000	340,000	500,000	200,000	600,000	700,000
Educational	41,130,000	6,600,000	8,300,000	2,400,000	4,500,000	4,500,000
Hospitals and Institutions	10,306,000	1,680,000	2,100,000	1,100,000	1,100,000	1,100,000
Public Buildings	14,993,000	1,400,000	2,600,000	900,000	3,900,000	1,500,000
Religious and Memorial	4,866,000	490,000	1,400,000	200,000	900,000	500,000
Social and Recreational	6,100,000	1,100,000	1,700,000	400,000	700,000	700,000
One- and Two-Family Houses	27,716,000	1,100,000	8,700,000	400,000	4,200,000	3,400,000
Apartments and Hotels	26,300,000	4,000,000	13,600,000	1,400,000	2,700,000	600,000
Total	$159,837,000	$19,010,000	$46,900,000	$7,900,000	$21,100,000	$15,500,000

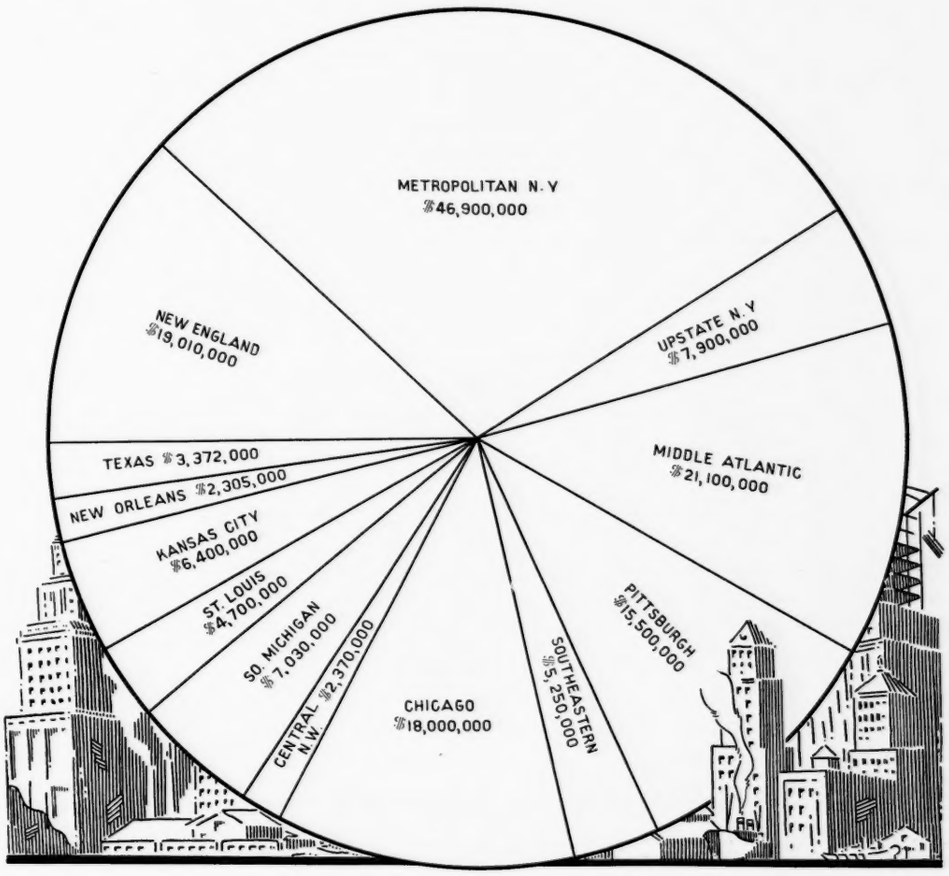


Fig. 1. Geographical distribution of heating and ventilating projects.

In making an analysis of the forecast for building, Table 1, and the forecast for the resulting heating and ventilating work, Table 2, several important points should be kept in mind:

1. The tables show the values only for the 37 states east of the Rocky Mountains, and not for the whole country, as did previous forecasts.
2. The forecasts do not include remodeling and modernizing.
3. The figures are in terms of the dollar of December, 1931.
4. Figures for the value of the heating and ventilating are in terms of the dollar value of the contract for the heating and ventilating work.
5. The building forecast does not include new buildings of small sizes not usually reported to organizations collecting building data.
6. In comparing the totals with other forecasts for values for previous years, note that Tables 1 and 2 do not include the so-called public works and utilities. The classification "Public Works and Utilities" does not include public buildings, but does include such projects as sewage systems, highways, dams, etc., and, therefore, has been omitted.

In order to obtain a better idea of the present building situation relative to other years, Table 3 is presented. The amount of money spent for the different classes of buildings in 1928 and 1930, and the amount forecast for 1932 are shown.

and air conditioning projects for 1932

Southeastern	Chicago	Central N.W.	So. Michigan	St. Louis	Kansas City	New Orleans	Texas
$700,000	$2,200,000	$360,000	$1,000,000	$700,000	$1,500,000	$200,000	$625,000
200,000	1,300,000	100,000	200,000	200,000	500,000	28,000	73,000
1,300,000	6,300,000	520,000	3,300,000	1,100,000	1,000,000	750,000	560,000
700,000	800,000	100,000	200,000	200,000	500,000	420,000	306,000
500,000	1,000,000	200,000	530,000	700,000	800,000	480,000	483,000
200,000	500,000	100,000	100,000	200,000	100,000	88,000	88,000
150,000	500,000	90,000	200,000	200,000	200,000	50,000	110,000
1,300,000	3,200,000	800,000	1,300,000	1,100,000	1,100,000	219,000	230,000
200,000	2,200,000	100,000	200,000	300,000	700,000	70,000	897,000
$5,250,000	$18,000,000	$2,370,000	$7,030,000	$4,700,000	$6,400,000	$2,305,000	$3,372,000

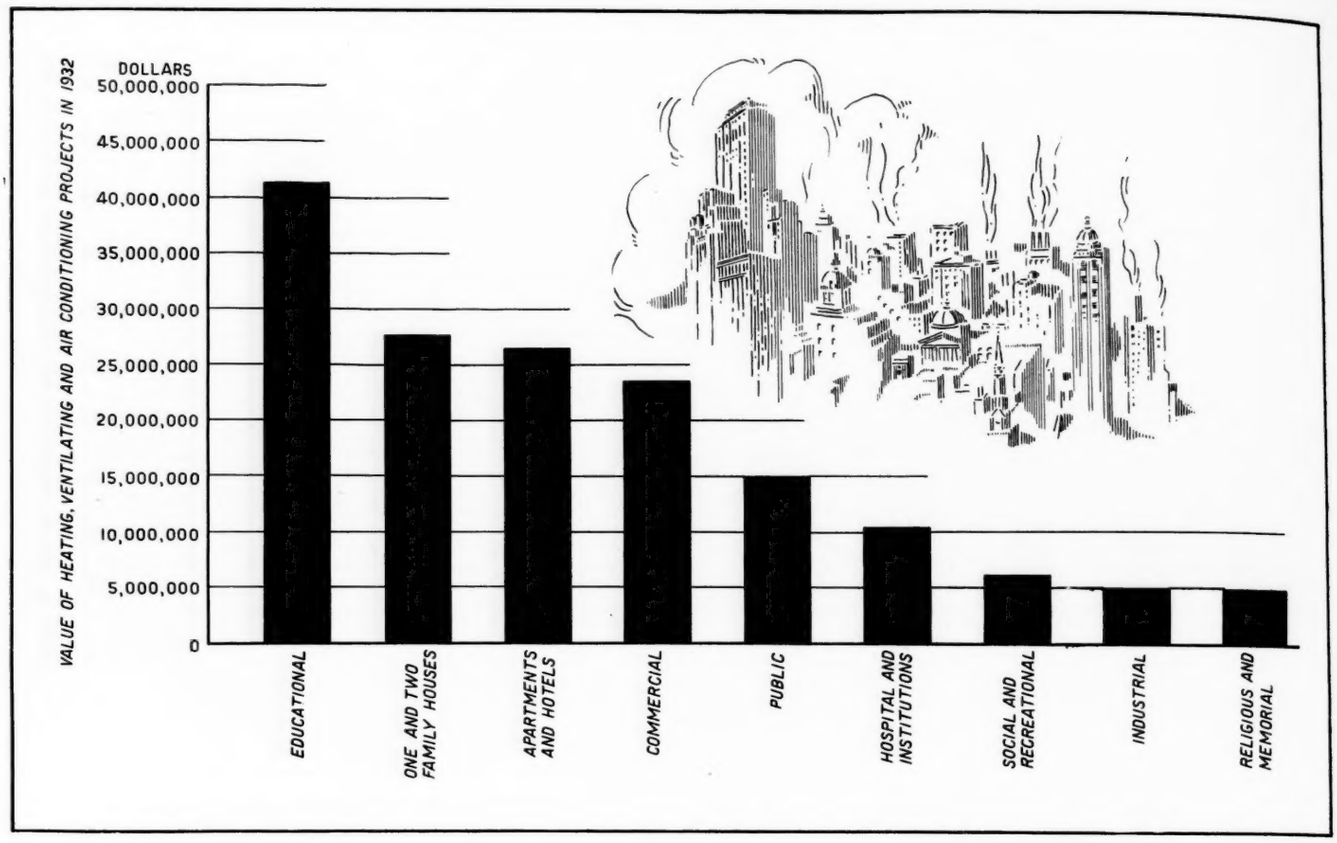


Fig. 2. Distribution of heating and ventilating projects among various classes of buildings.

TABLE 3

AMOUNT OF BUILDING IN 37 STATES EAST OF THE ROCKIES—IN THOUSANDS OF DOLLARS

(Not including Public Works and Utilities)

	Actual, 1928	*Actual, 1930*	*Forecast for 1932*
Commercial	$884,604	$628,812	$298,000
Industrial	508,836	256,632	104,000
Educational	399,000	376,056	297,000
Hospital & Institutions	164,724	163,128	94,800
Public	76,248	139,812	217,500
Religious & Memorial	127,944	92,832	47,900
Social & Recreational	214,128	113,304	74,600
Residential, all types	2,788,320	1,101,312	920,000
Total	$5,163,804	2,871,888	2,053,800

Some interesting points may be noted in the table. For example, as compared with 1928 the forecast shows a total drop of slightly over 60%, while public buildings alone is expected to increase 185%. A severe decline is anticipated in industrial buildings, amounting to 79.5%. (Bear in mind that these comparisons are with 1928, and not with 1931).

Commercial buildings show a drop, compared with 1928, of over 66%, while in educational buildings the expected decrease is only 25.6%. Residential buildings, on the other hand, show a drop of 67%.

Fig. 1 shows graphically the distribution of value of heating and ventilating projects among the different types of buildings. Educational buildings lead, followed by residential and hotel buildings. In the distribution of projects among the different sections of the country, Fig. 2, metropolitan New York easily leads, with the Middle Atlantic States, New England and Chicago following.

In a general way, heating and ventilating products can be classified according to the type of building in which they are to be used. There is, necessarily, overlapping, but by and large from the standpoint of the heating, ventilating or air conditioning manufacturer the classifications would be:

Residences
Industrial buildings
All other types

For example, the type of heating equipment which goes into homes is quite different from that which is utilized in industrial buildings. The devices used for the heating of factories are not along the same lines as those used in apartments, office buildings, churches, etc.

It is interesting to note the distribution of heating and ventilating work forecast for 1932 among these types of buildings. This is shown in Table 4.

TABLE 4

DISTRIBUTION OF HEATING AND VENTILATING AMONG THREE MAJOR CLASSES OF BUILDINGS

Residences	$27,716,000	17.3%
Industrial	4,941,000	3.1%
All Others	127,180,000	79.6%

The Artists Poke Fun at Our Industry

Although the jibes of the humorists may at times seem somewhat caustic, they are not without value in broadening the public consciousness of and demand for the comfort of cooling and air conditioning. The cartoons, too, are a result of the increased attention of newspapers and popular magazines to the subject.

Judge

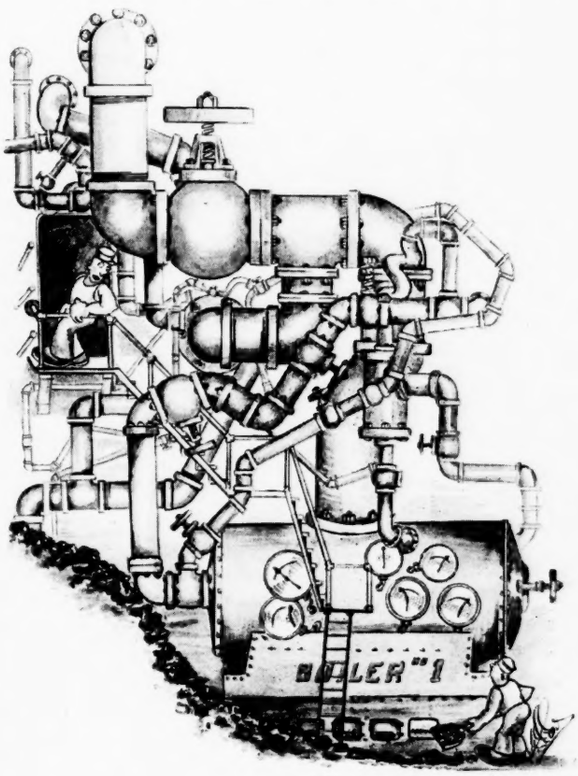
"Need a bit o' ice for the shaker?"
"Whoopee! I'll have some in a minute from this hot water system."

The New Yorker

"You see, Madam, Nature never intended us to live in steam-heated houses."

The Saturday Evening Post

"Could I step outside a moment to get warmed up a bit?

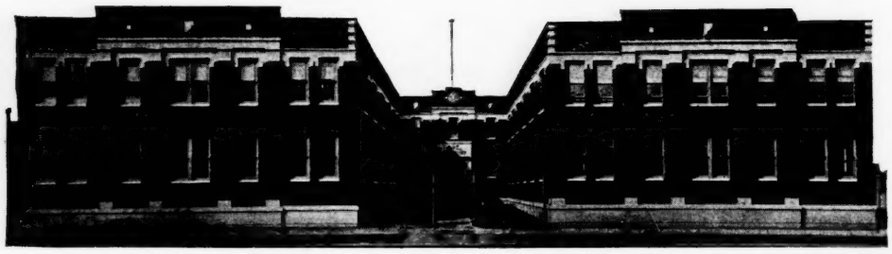


The Saturday Evening Post

"Hey, Mike! Yer missus called up and sez you let the kitchen fire go out."

Ballyhoo

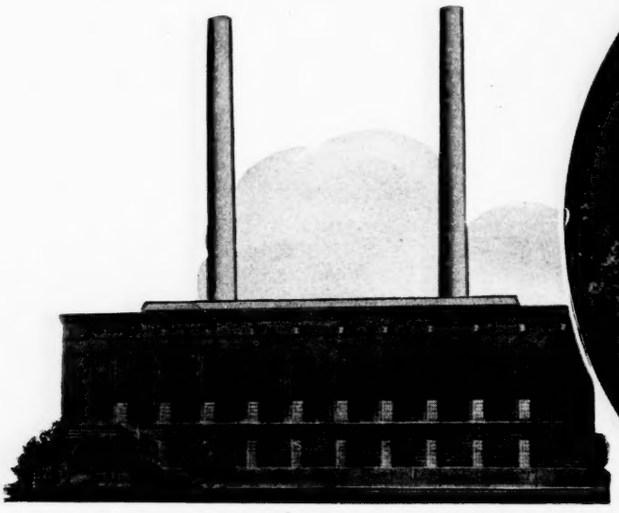
"Pssst,—Is it air cooled?"



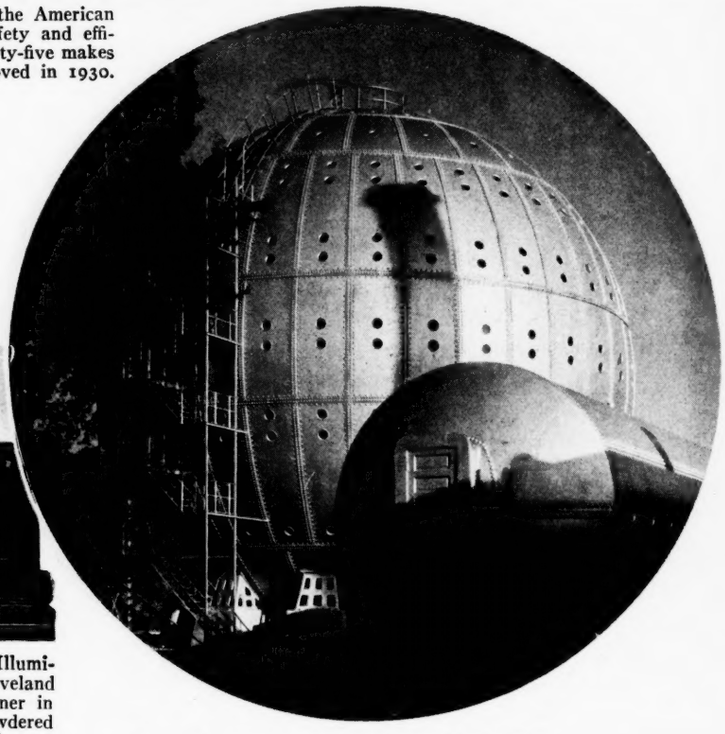
A nationally known institution—the Testing Laboratory of the American Gas Association, where gas-fired equipment is tested for safety and efficiency before it is given the Blue Star Seal of Approval. Ninety-five makes of boilers and furnaces and 117 space heaters were so approved in 1930.

THE INDUSTRY

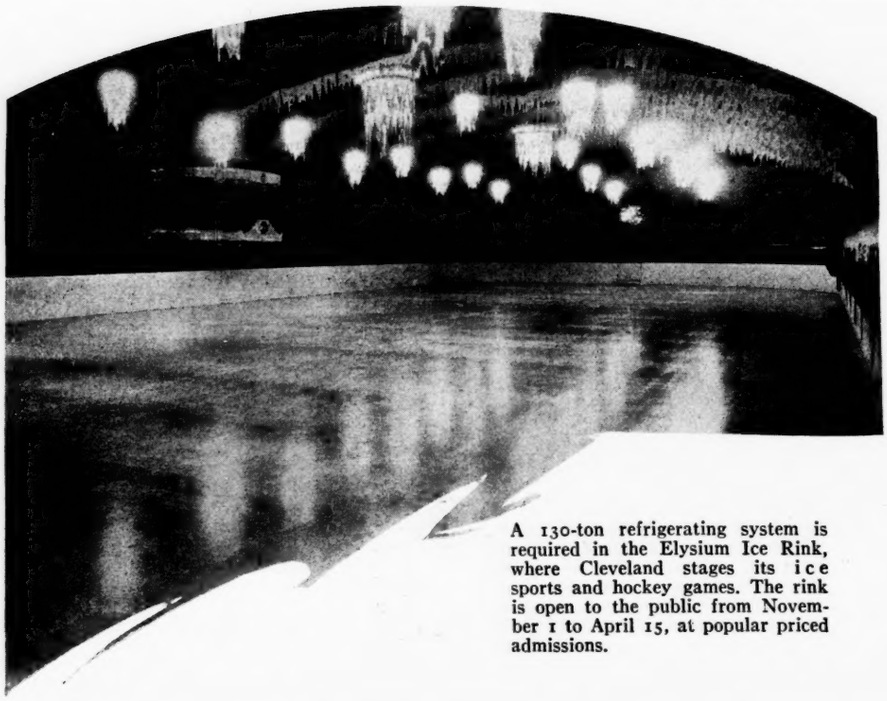
Residents of Cleveland have a keen appreciation of the importance of the industry which is exhibiting its products and accomplishments at the Exposition,



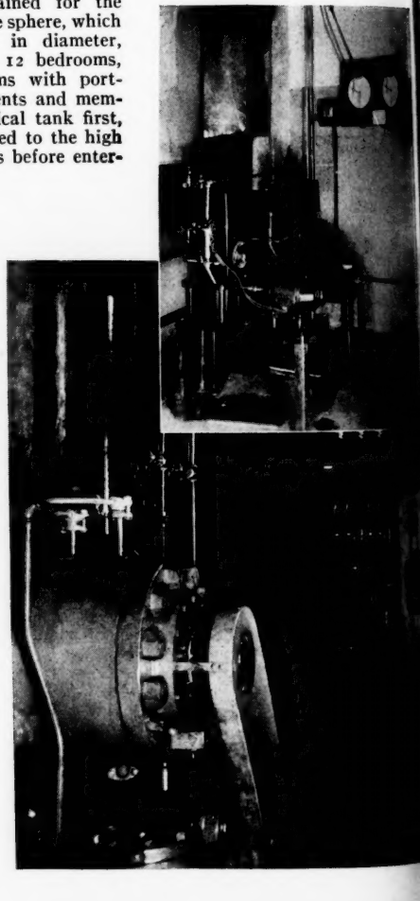
The East Twentieth Street Station of the Cleveland Electric Illuminating Company, from which many of the downtown Cleveland buildings secure their steam for heating similar to the manner in which they secure their electricity for light and power. Powdered coal is burned in three boilers rated at 4338 hp. The plant has an ultimate capacity of 12 boilers.



One of the most unusual in the world, the Timken Hospital, where pressures between 5 and 30 lb. above normal are maintained for the treatment of various diseases. The sphere, which is five stories high and 64 ft. in diameter, weighs 900 tons. Each floor has 12 bedrooms, which resemble steamer staterooms with portholes for admission of light. Patients and members of the staff enter the cylindrical tank first, where they are gradually accustomed to the high pressures and special air conditions before entering the sphere.

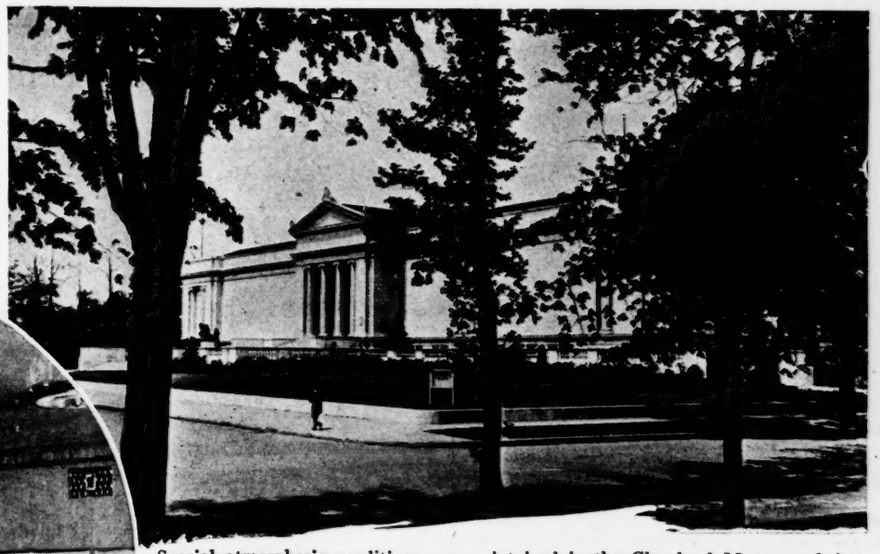


A 130-ton refrigerating system is required in the Elysium Ice Rink, where Cleveland stages its ice sports and hockey games. The rink is open to the public from November 1 to April 15, at popular priced admissions.

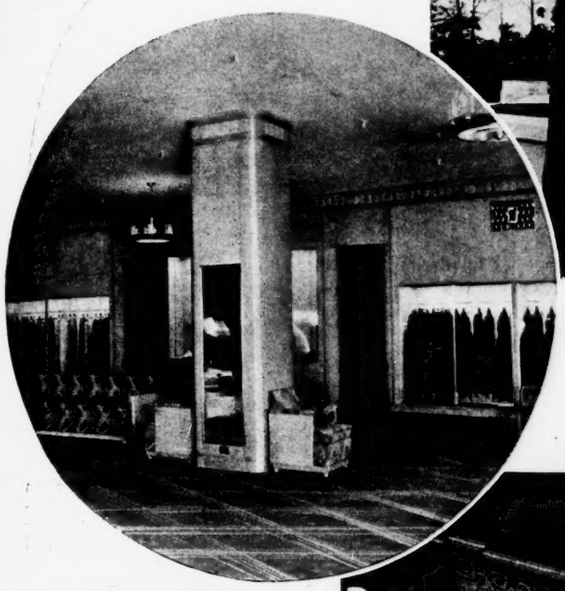


N CLEVELAND

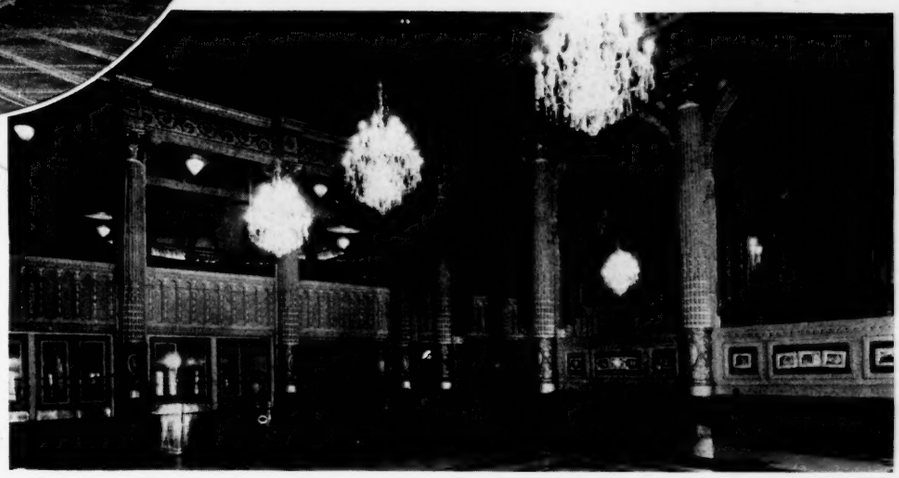
due to their contact with the city's many fine examples of heating, ventilating and air conditioning, a few of which are here illustrated.



Special atmospheric conditions are maintained in the Cleveland Museum of Art, in Wade Park, so as to protect and preserve the objects of art on exhibition here. Requirements in the Cleveland museum, as in similar institutions in other cities, are such that proper air cleanliness, humidity and temperature are vitally necessary to preserve priceless pieces of furniture, textiles, paintings, etc.

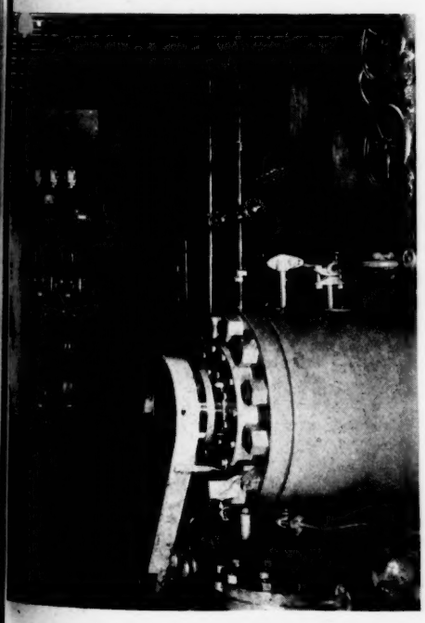


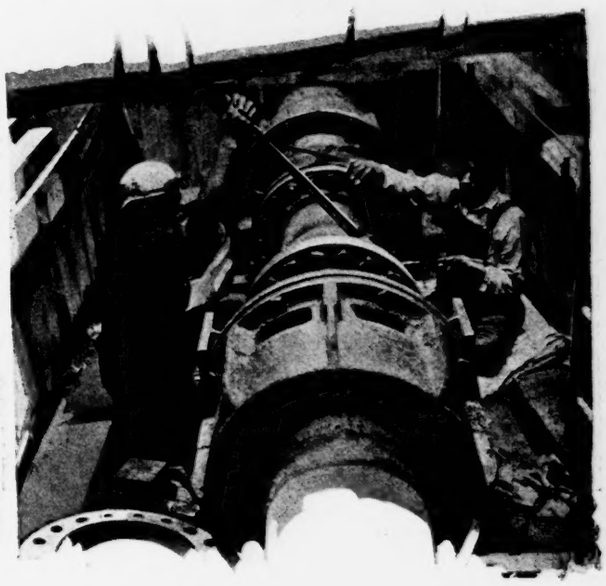
(*Above*) Note the decorative inlet grilles in the platinum room fur salon on the third floor of the Higbee Company air conditioned department store, which adjoins the Terminal Tower and forms a part of the great building project for this part of downtown Cleveland.



In modern theaters, pleasing the patrons extends to providing not only costly art objects and elaborate interiors, but also unseen mechanical equipment equally valuable by its contributions to comfortable environment.

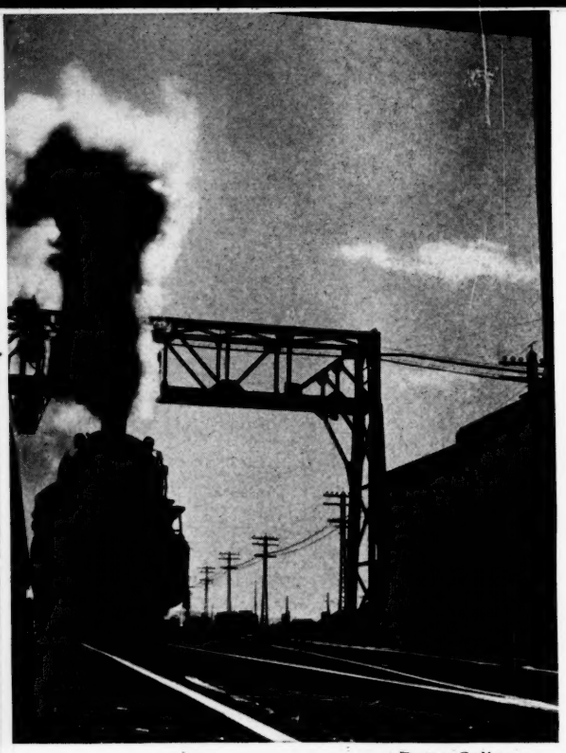
(*Left*) Cleveland's theater - going public finds comfort in all seasons through application of air conditioning and cooling. The view to the left shows the compressor units which automatically control the temperature and humidity in Keith's Palace Theater. Below are shown the refrigerating machines, starting panels, and condensers





(*Right*) Under the surface of every large city, miles of piping, conduit and wires continuously maintain a multiplicity of modern service demands. In Cleveland, too, are found mains bringing steam for heating comfort to many buildings, which when so heated aid in reducing traffic congestion by requiring no coal deliveries or ash removal.

Progress in Railroad Car Cooling



Ewing Galloway

Perhaps no chapter in the 100-year history of American railroads is more spectacular than that of the improvements in passenger comfort. Vastly different are the conditions in the latest Missouri-Kansas-Texas diner, and those endured by the passengers of one of the finest trains of over 100 years ago, as shown above.

(Left) While the refrigerated car for the transportation of perishable food products was in wide use before the passenger car with air cooling, progressive changes continue to be made. The modern iceless refrigerated car illustrated below utilizes, in general, the same method and equipment as is being used in an elaborate experiment for the air conditioning of homes.

(Below) Progress in railroad car cooling has not been confined to the mechanical refrigerated cars. Development, too, has included ice. A Pennsylvania ice-cooled diner is shown below.

(Left) This cooling and heating unit on a Chicago and Northwestern diner strongly recalls the unit heater. This unit weighs but 300 lb., and the units can be easily removed during the winter if desired.

(Right) Hats off to air conditioning! These two passengers on an air conditioned diner seem somewhat bewildered by the power of the exhaust fans.

If you are interested in the latest step in the progress of

SUMMER AIR-CONDITIONING FOR THE HOME

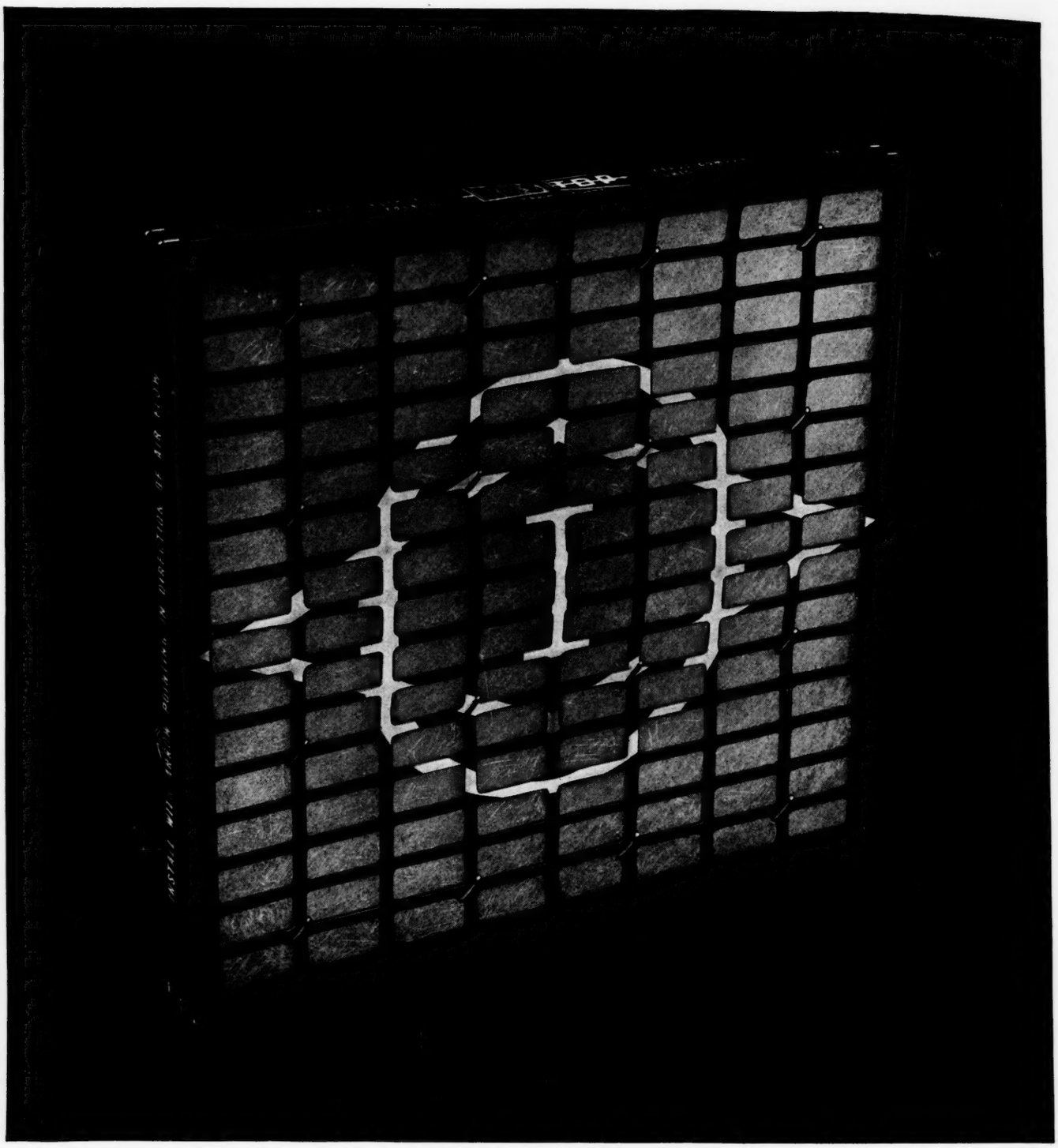
BOOTHS

59 and 61

See the SILICA GEL *display at the Heating and Ventilating Exposition at Cleveland*

January 25th.-26th.

THE SILICA GEL CORP. • BALTIMORE, MD.



Dustop air filter consists of scientifically prepared glass wool, enclosed in a strong, cleanly perforated paper shell

DUSTOP

· Stops Dust ·

Filter Air Through Glass Wool

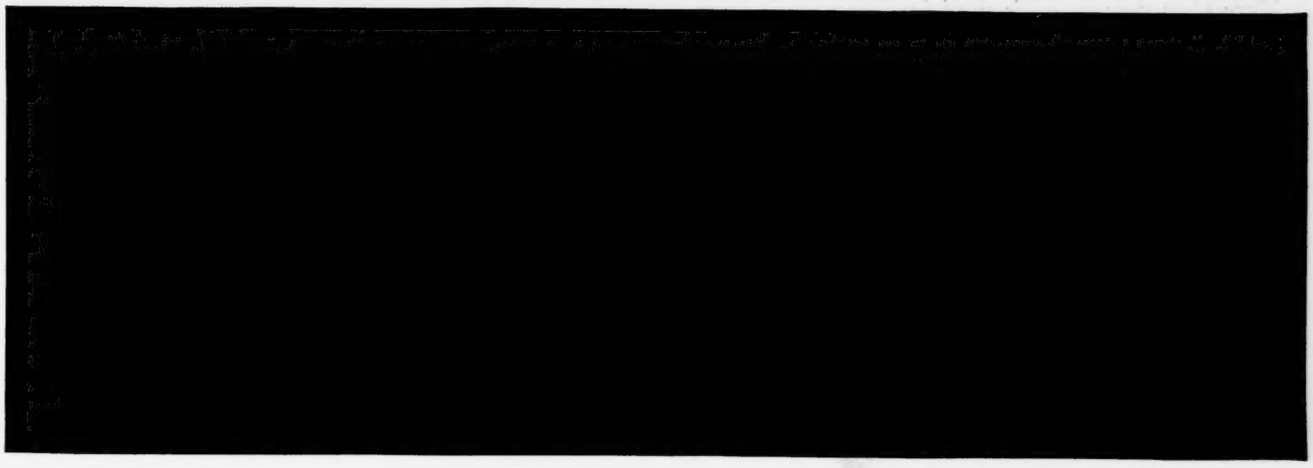
● The Owens-Illinois Glass Company, for many years outstanding in the glass industry, after long research offers "Dustop", a complete filter unit in which "glass wool" serves as the filtering medium.

High dust removal efficiency. Because of its capacity for holding an unusual amount of dust by weight, "Dustop" has a higher dust removal efficiency than other filters.

Low resistance—noiseless. "Dustop" is of low resistance. Its light weight paper container reduces noise under vibration, (the whole unit weighs only two pounds). The paper to metal frame contact forms a practically perfect seal.

Low price—easy replacement. The extremely simple design of "Dustop" makes feasible the replacement of the entire unit when dirty. Its paper container makes quick disposal possible. Replacement is very easy.

"Dustop" is a contribution to industry in the interest of clean air AT THE LOWEST POSSIBLE cost. Write for particulars and prices. Owens-Illinois Glass Company, Industrial Materials Division, Toledo, Ohio.



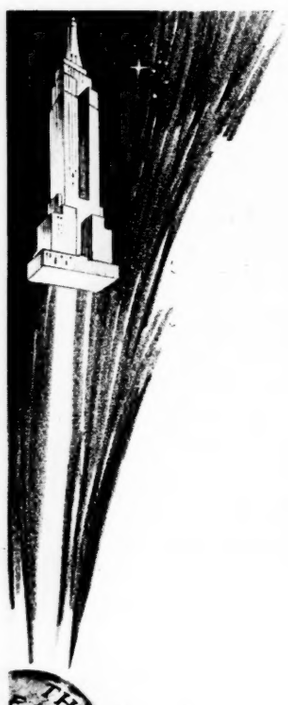
Do You Realize That—

It would require one hundred 80*-car freight trains to haul all the cast iron boilers and radiators made in one year?*

•

Sales of unit ventilators for schoolrooms during ten months of 1931 amounted to over two and a half million dollars?

•



There is enough energy in the gas used for central house-heating in one year to raise the Empire State Building 1365 *miles in the air?*

•

Sales of fans and blowers used in the larger ventilating systems amounted to a million and three quarter dollars last year?

•

The air conditioning systems installed in industrial plants require a total, at peak, of 50,000 *hp.? And that for comfort conditioning the total is* 90,000 *hp.?*

•

Even in the depression year of 1931 industrial unit heaters to the amount of $3,000,000 were sold?

•

More than enough oil is used in domestic oil burners in this country in one year to float the Leviathan, Majestic, Berengaria, Olympic, Bremen, Europa, Acquitania, Ile de France, Paris, and Mauretania?

•

Over 1,000,000 tons of briquets were burned in this country in 1930?

•

While the amount of building in the first ten months of 1931 *seems extraordinarily low, nevertheless this period accounted for far more building than the first ten months of any year from* 1911 *to* 1918?

There are 8,000,000 *tons of coke used for domestic heating in this country in one year?*

•

If all the 1931 copies of HEATING AND VENTILATING were piled one on top the other the height of the pile would exceed that of the combined heights of the Woolworth Building, New York, the United Shoe Machinery Building in Boston, the Union Trust Building in Detroit and the New Yorker Hotel in New York?

•

One hundred and sixty-one district heating companies have over 820 miles of mains which serve 80,000 customers?

•

There are now over 650,000 *domestic oil burner installations?*

•

Sales of small housed and propeller fans, such as are used for kitchen ventilation, amount to over a million and a half dollars a year?

•

A fuel oil pipe line is being planned for a Long Island town, so that burner owners will be furnished oil through a meter in the same way as gas for cooking is supplied?

•

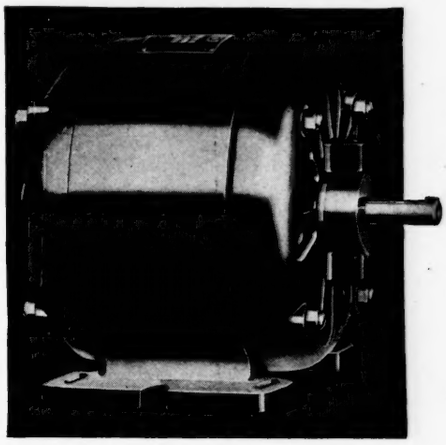
Coal is still King in domestic heating, 109,000,000 tons, or thereabouts, being used for the heating of buildings every year?

•

In 11 *months of* 1931 *nearly* 8000 *stokers were sold for heating installations?*

•

The amount of fuel used to heat the buildings in New York, Pennsylvania, Ohio and Illinois is greater than that required in the 28 states west of the Mississippi?



Year After Year Performance Proves Ohio Motor Reliability

AIR CONDITIONING for office and residence.

Recently Motor operated units for Air Conditioning and Humidifying have been developed for office and residence service.

Ohio is taking a prominent part, because such Motors must run continuously and silently.

Ohio Motors have for years been standard factory equipment on many Oil Burner and Ventilating Systems. They were selected not on price, but on actual performance tests.

The quiet and reliable operation of these motors is easily explained. It is a fact that all raw material, every part, each assembly and each completed Ohio Motor must pass 127 inspections and tests before shipment. These are not occasional tests, but are 100% inclusive of every item.

Each Ohio Motor is in fact a custom built Motor. That is why they stand up under the most severe operating conditions and are specified year after year by those who have learned to depend on Ohio Motor Reliability.

Ohio Engineers with more than a quarter century experience in the small Motor field will gladly assist you in selecting the right Motor for your needs.

THE OHIO ELECTRIC MFG. CO.

5912 Maurice Avenue, CLEVELAND, OHIO

Ohio Motors meet all N. E. M. A. and N.E.L.A. specifications

OHIO reliable MOTORS

Ohio Motors are available in sizes from 1/30 to 1 horsepower.

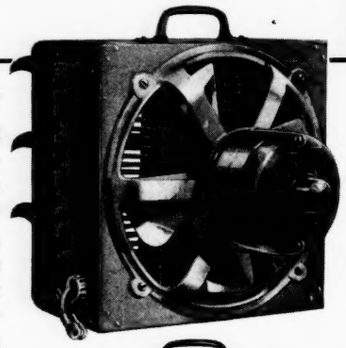
OHIO MOTORS

Efficient · Practical · Economical

Heat by Electricity

with the

AMERICAN UNIT HEATER



AN ENTIRELY *new* achievement now makes electric heating practical and, in many cases, actually less costly than other methods. The American Electric Unit Heater embodies new and exclusive features of design and construction which have definitely proved that electric heating can be profitably applied in many commercial and industrial installations.

Exceptional efficiency is gained by the exclusive type of heating element, which consists of helicoil sheath wire strips, cast integrally within aluminum alloy fins, increasing the convection surface at least 25 times. This exclusive design provides a *big heat delivery at lower operating temperature of the heating elements*—and thus insures absolute safety and dependable operation over a long period of years. An additional safety factor is an automatic cutout switch in case of motor trouble.

Besides this general purpose unit we manufacture Electromode, a built-in wall type heater based upon the same principles of design and operation, for apartment houses, banks, office and public buildings and private residences. You should know about this practical, economical application of electricity to the problems of heating.

OPPORTUNITY FOR DISTRIBUTORS. Write now for complete information about American Electric Unit Heaters and details of our attractive proposition for qualified sales representatives in territory not yet assigned. No obligation; inquire today.

Ideal for These Difficult Heating Needs

Applicable for space heating regardless of area, the American Electric Unit Heater is especially advantageous for use in isolated small buildings and temporary structures. Here are a few ideal uses.

Offices during "off heat season" or continuously in mild climates.
Dry kilns.
Isolated industrial and rail offices and shops.
Crane cabs.
Pump, meter and valve houses.
Filling stations.
Watchman stations and towers.
Transformer stations.
Mines.
Construction offices.
Contractor and engineer location offices.
Chicken brooder and incubator heating.
Garages.
Green houses.
Industrial heating in power centers.
Isolated power houses and sub-stations.
Manhole stations.
Screen houses for power plants.
Depot and ticket offices.
Storage rooms.
Greasing stations.
Theatre ticket offices, lobbies and dressing rooms.
Waiting rooms.
Pump houses.
Scale houses.
Retarder stations in "hump" railroad yards.

Heater Division

American Foundry Equipment Co.

501 Byrkit Ave., Mishawaka, Ind.

Keep the facts within your grasp—

This important business of supplying heated air, cooled air, and clean air, under an endless variety of conditions, requires the experience of the past, plus the latest and best that modern experiment and research can supply.

If you are a heating and ventilating engineer or contractor responsible for the proper selection and installation of equipment, you want to know about the latest developments in your field; to be kept in touch with the latest news and data without wasting time. And there is only one practical way to accomplish this: read regularly at least one first-class journal which specializes in the kind of information you need.

Every month, HEATING AND VENTILATING (now published by The Industrial Press, publishers of MACHINERY) gives you news of this rapidly expanding field through its editorial and advertising columns. In addition there is a consulting service which supplies a wealth of data that you can readily turn into cash on your own work.

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EACH MONTH—

information about the heating, ventilating and air conditioning industry that is indispensable to engineers and contractors in this field.

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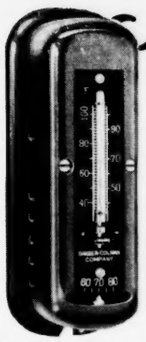
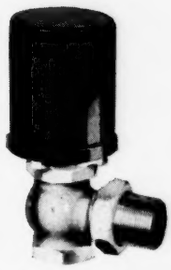
CLEVELAND, OHIO, January 28-29
Booth No. 138

Featuring

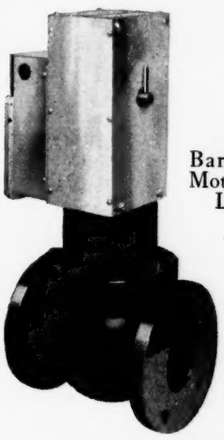
Electrically actuated temperature control equipment



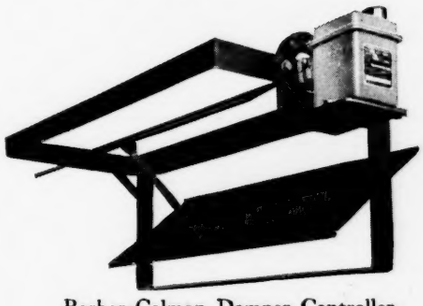
Barber-Colman Room Thermostat with Thermometer and External Adjustment



Barber-Colman Motor-Operated Packless Valve, Angle Pattern



Barber-Colman Motor-Operated Line Valve



Barber-Colman Damper Controller Direct Connected to Mixing Damper

YOU are invited to Booth No. 138 at the Exposition in Cleveland to view the Barber-Colman *Electric* System of Temperature Control, one of the most interesting developments in this field.

Here you will find a complete showing of Barber-Colman Thermostats, Electric Motor-Operated Valves, Damper Controllers and other equipment used in this system—and demonstrations of the application to various types of heating apparatus and systems.

There will be on display also several unit ventilators of different makes and designs equipped to show the operation of control units of this system.

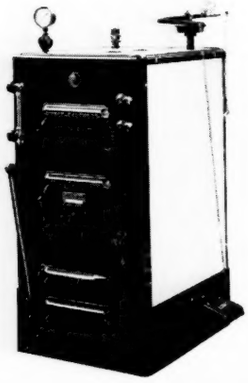
Be sure to visit this interesting exhibit. An attendant will be at your service.

BARBER-COLMAN COMPANY
ROCKFORD, ILLINOIS
Manufacturers of
THE BARBER-COLMAN ELECTRIC SYSTEM
OF TEMPERATURE CONTROL

PIERCE EASTWOOD
BOILERS *and* RADIATORS

Insure satisfaction by installing this combination on every steam or hot water heating job. Pierce-Eastwood boilers are *guaranteed* to deliver their full rated heating capacity.

More heating surface is a *plus* feature of Pierce-Eastwood Screw Nipple radiation.



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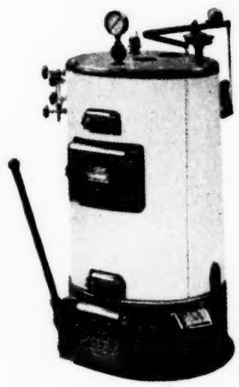
Ames Steel High Pressure Boilers
Ames High Speed Engines
Hot Water Supply Boilers
Cast Iron Screw Nipple Radiators
Packless Valves
Steam Gauges
Altitude Gauges
Hot Water Thermometers

Pierce Boilers are Tapped for Water Feeders

PIERCE, BUTLER & PIERCE MFG. CORP.
41 East 42nd St., New York Branches in Principal Cities
Manufacturers of Heating Equipment since 1839

AMES IRON WORKS—Division of Pierce, Butler & Pierce Mfg. Corp., manufacturers of Una-flow Engines, Steel Boilers and Road Rollers.



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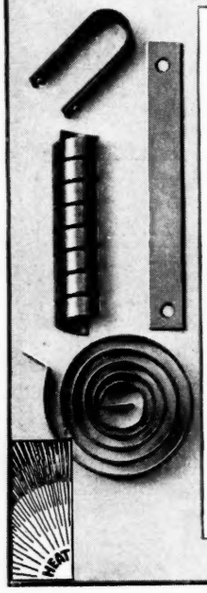
CHACE THERMOSTATIC BIMETAL
"It Bends with the Heat"

SHEETS, STRIPS OR FORMED TO SPECIFICATIONS



Oil burner control manufacturers have chosen Chace Thermostatic Bimetal because of its high sensitivity, accuracy and uniformity. Reliable automatic action at definite predetermined temperature assured. 1200° F. without distortion. Consult our Engineering Department.

Manufactured by
W. M. CHACE VALVE CO.
1606 Beard Ave. Detroit, Mich.

Can YOU Answer These Questions?

1. Is there any alloy that will melt at a temperature below the boiling point of water?
2. What gage is used for seamless tubing and does it apply to all metals?
3. Is "extra heavy" and "double extra heavy" wrought or steel pipe larger in diameter than standard weight pipe?
4. One of the steels in the S.A.E. Specifications is S.A.E. nickel steel 2350. What does the number signify?
5. What alloy is known as "red brass" and how does it compare with "yellow brass"?

These five sample questions are from a book containing 100 mechanical test questions and their answers. This book will be sent FREE and without obligation to anyone whose work is along mechanical lines.

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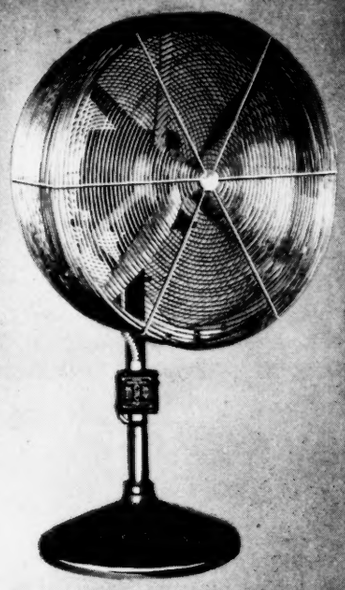
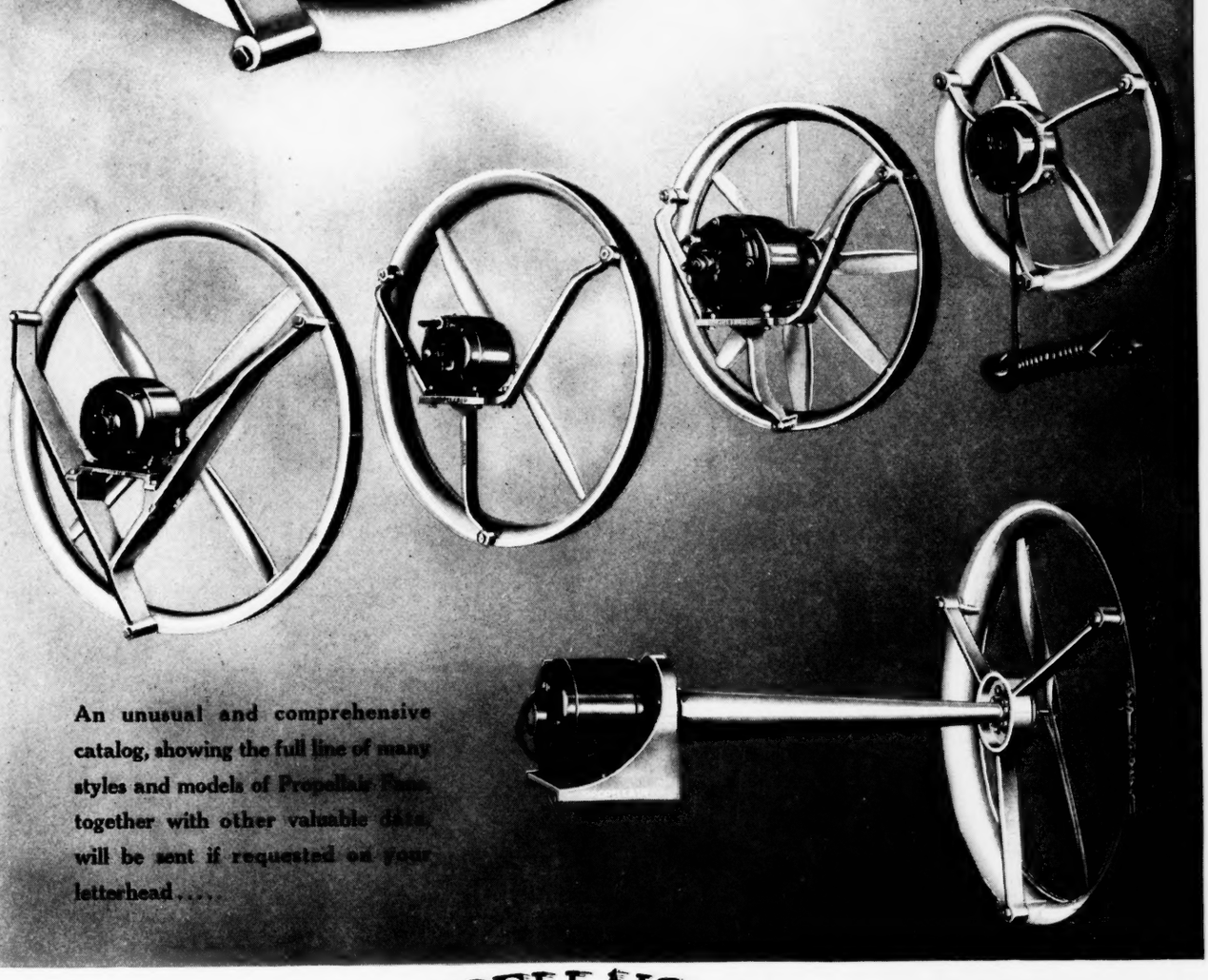
TRADE MARK REG.

Airplane Propeller Exhaust and Ventilating Fans

The CURVED ENTRANCE HOUSING of Propellair Fans has proved its point. Standard Code Tests, conducted in the laboratories of various universities, show that Propellair Fans move more air per horse power and equal diameter propeller than any other airplane-propeller type fan. In addition to a propeller of accurate design, the CURVED ENTRANCE HOUSING, illustrated here and used on all Propellair Fans, properly guides the air currents, offers least resistance to their flow, and enables the full length of the blades to be efficient without restricting the area of the fan outlet.

Propellair Fans have non-overloading characteristics, the horse power curve being practically flat from free air condition to maximum static pressure at no air discharge. A safeguard against motor burn-outs—in other words you cannot overload the motor.





An unusual and comprehensive catalog, showing the full line of many styles and models of Propellair Fans, together with other valuable data, will be sent if requested on your letterhead.....

PROPELLAIR-INC
COLUMBUS, OHIO

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Cleveland, Ohio, January 25—29, 1932.

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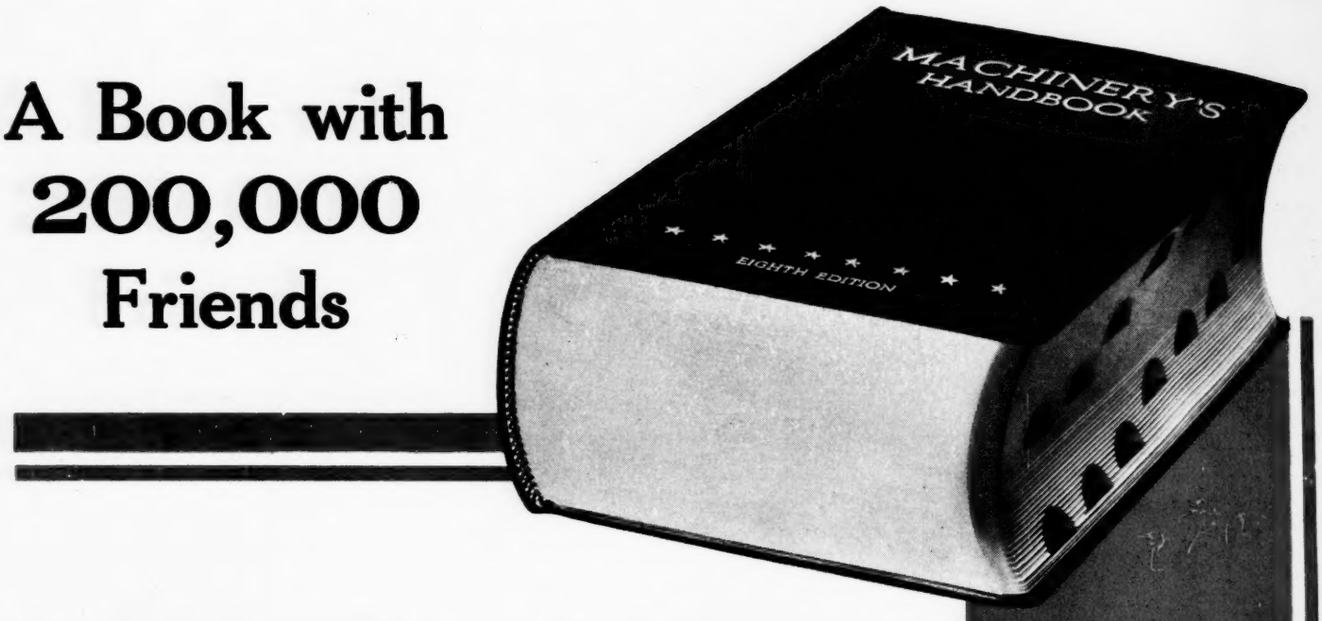

Machinery's Handbook

Scattered throughout the industrial world are 200,000 copies of MACHINERY'S Handbook—each the valued friend of some engineer, plant superintendent, foreman, draftsman, or experienced workman, who daily consults its pages to get facts and figures needed in designing department or shop. Simplicity, completeness and *reliability* have made MACHINERY'S Handbook the one volume these men use when a problem is before them.

1592 pages of time-saving information—data, tables and concise up-to-date facts.

The material for MACHINERY'S Handbook has been selected from the almost limitless supply pertaining to mechanical subjects primarily to meet the requirements of the designing and manufacturing departments of machine-building plants. Most of the tables and other material in MACHINERY'S Handbook are there because of many requests for such data from experienced designers and mechanics.

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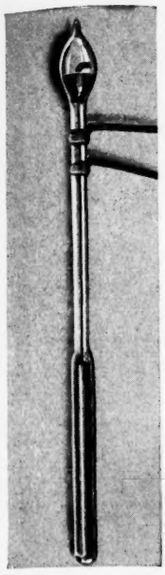

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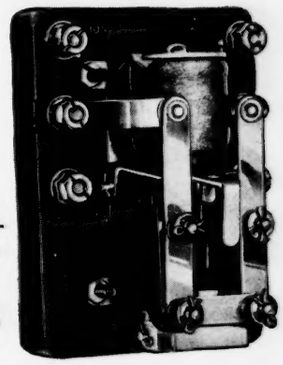

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ALPHABETICAL INDEX TO ADVERTISEMENTS

A

American Air Filter Co., Inc. 23
American Foundry Equipment Co. 42
American Propeller Co. 50
American Temperature Indicating Co. 48

B

Badger & Sons Co., E. B. 3
Barber-Colman Co. 43

C

Chace Valve Co., W. M. 44
Chicago Pump Co. 12

F

Frick Co. 25

G

Greene Gas Cleaner Co. 47

H

Harbula, M. G. 47

I

Industrial Press 46

J

Janette Mfg. Co. 49

M

McCord Radiator & Mfg. Co. ..Inside Front Cover
Mercoid Corporation 10

N

Nash Engineering Co. 6

O

Ohio Electric Mfg. Co. 41
Owens-Illinois Glass Co. 38-39

P

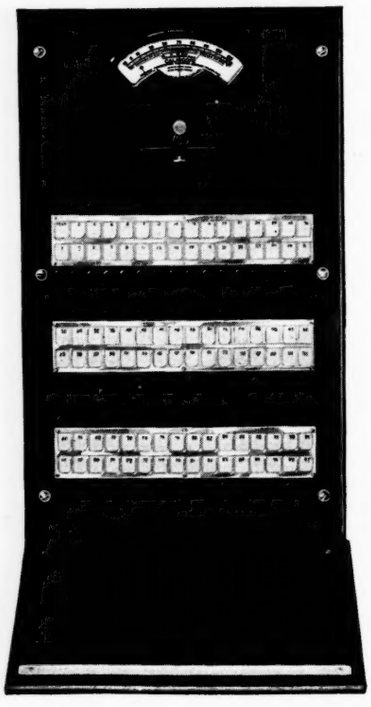
Penn Electric Switch Co. 7
Pierce, Butler & Pierce Mfg. Corp. 44
Powers Regulator Co. 8
Propellair, Inc. 45

S

Sarco Co., Inc. 4
Silica Gel Corp. 37
Struthers-Dunn, Inc. 47
Surface Combustion Corp. 49

W

Warren Webster & Co. .....Outside Back Cover
Watts Regulator Co. 13
Weil-McLain Co. .....Inside Back Cover
Whitlock Coil Pipe Co. 26-27



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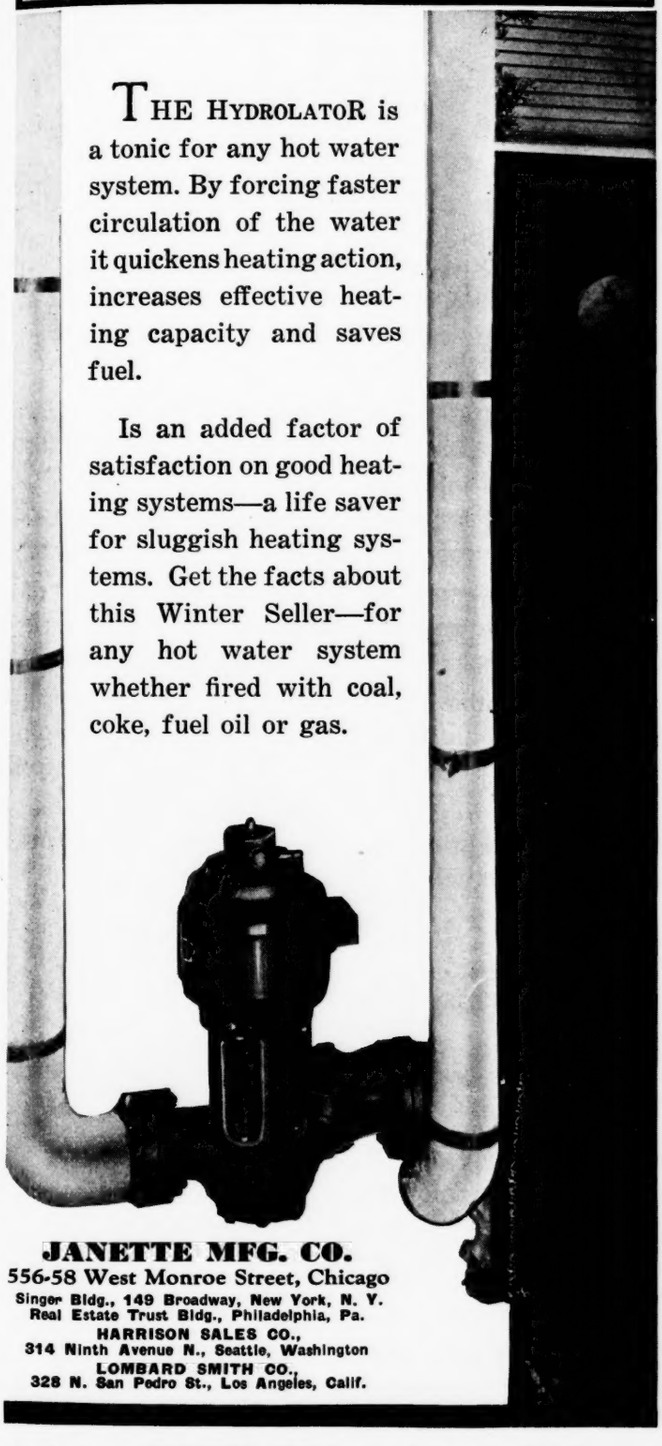

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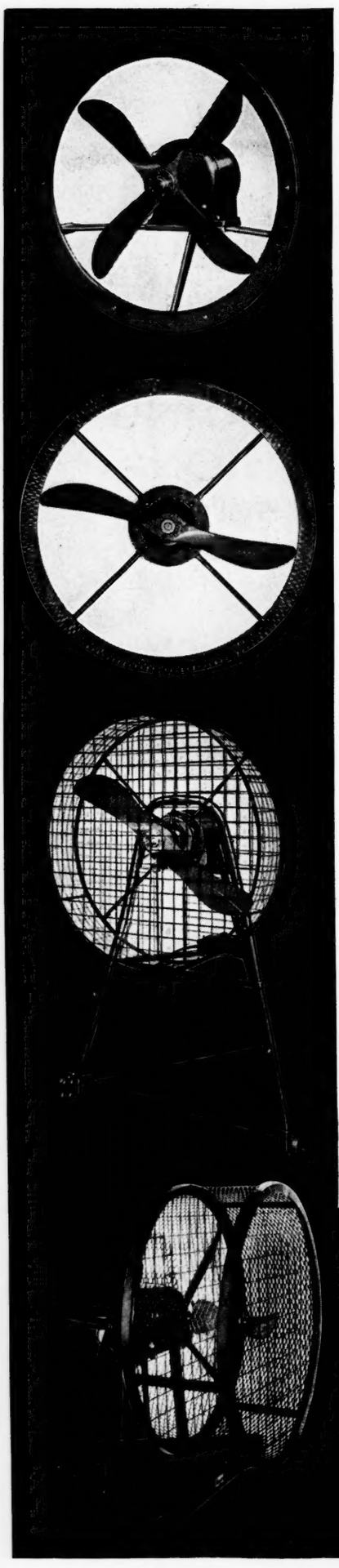

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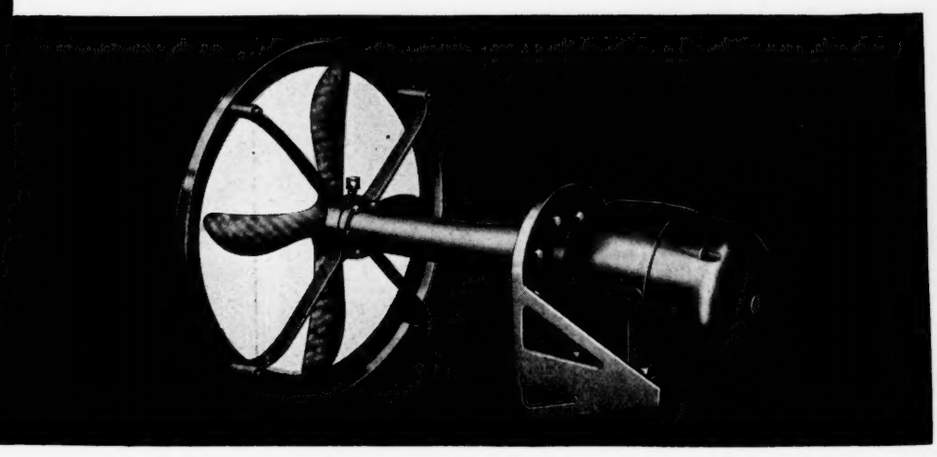

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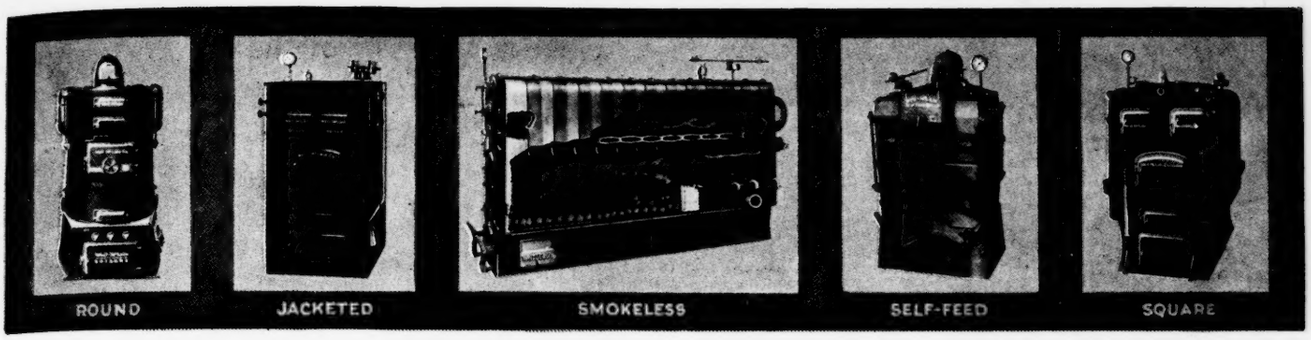

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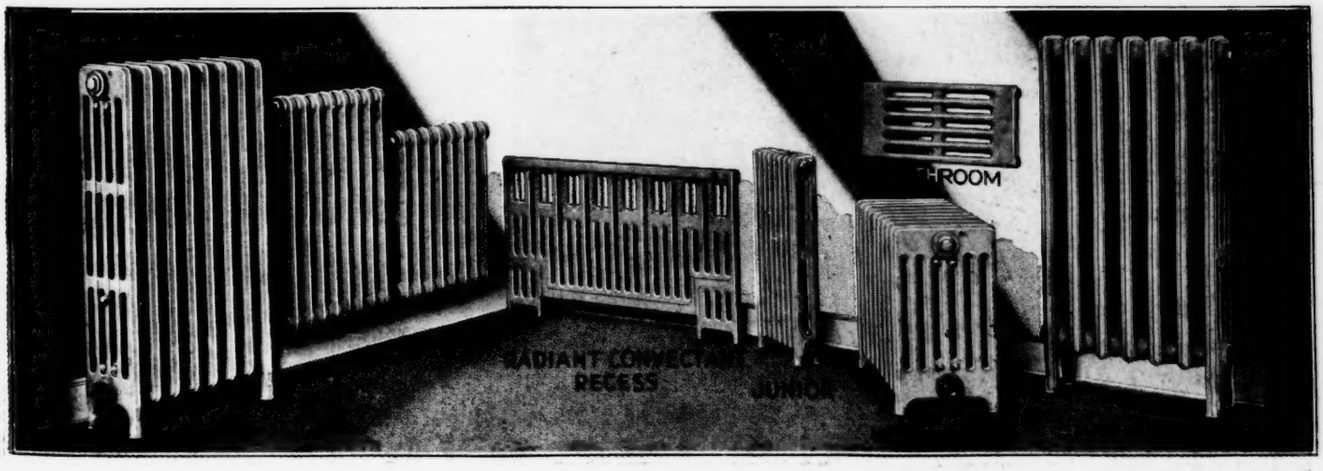

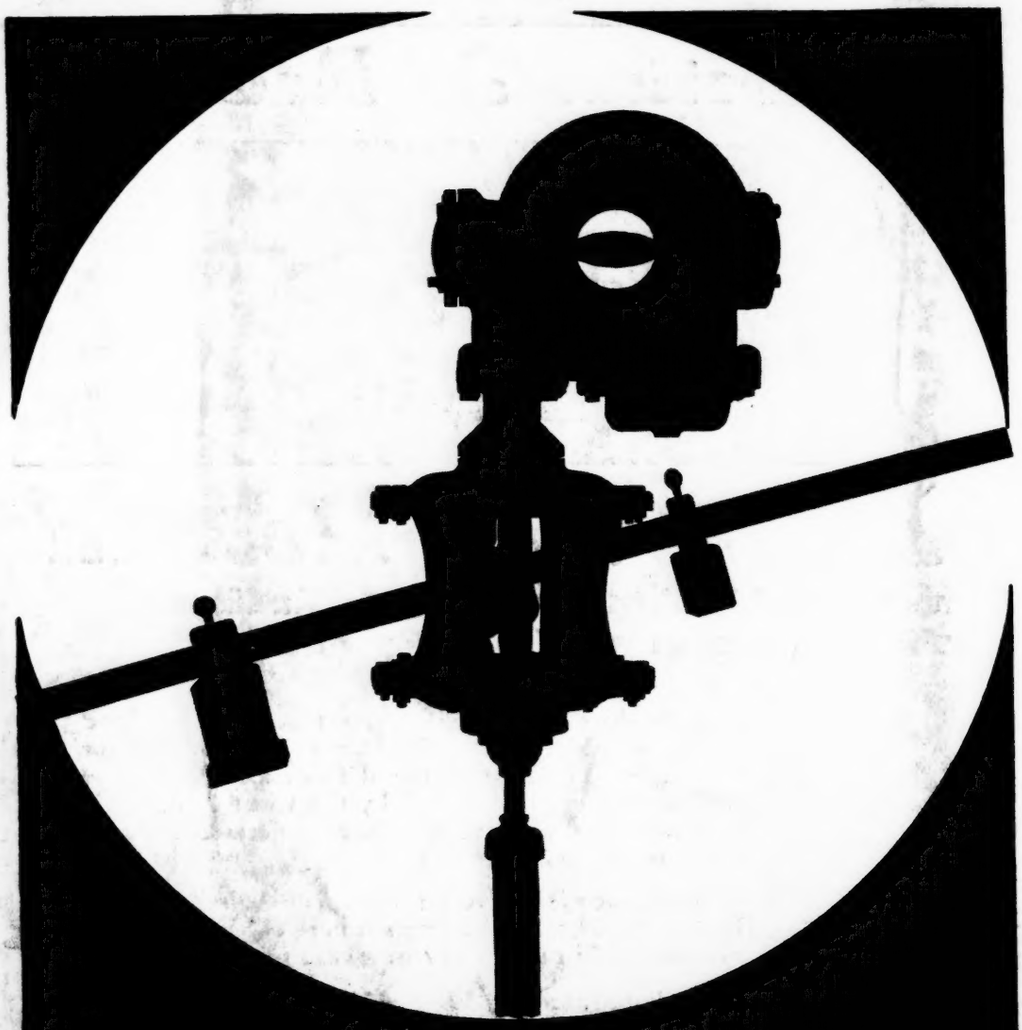

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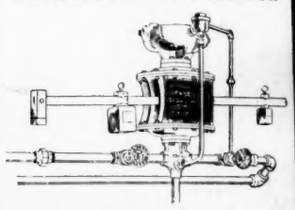

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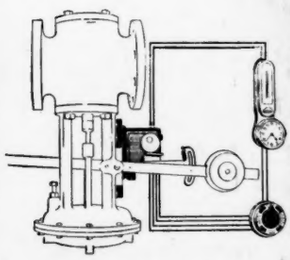
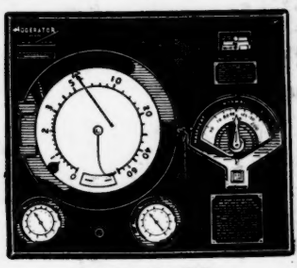
Another simple central control. Used with Improved Webster Vacuum Systems.



ZONE CONTROL

Supplementary Zone Control may be included with any type of Webster Central Control—Hylo or Moderator.



VARIATOR CONTROL PANEL

One of several types of control panels used with Improved Webster Systems.

See the complete display of Webster Central Controls and Improved Webster Systems at Cleveland, January 25-29, 1932.